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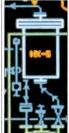
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CAD: The Big Picture for Micros

Glenn Hart/CAD, or computer-aided design, is hogging one innovation after another. While giant AutoCAD still dominates the market, upstarts like ProDesign II and Generic CADD are offering limited but nonetheless real CAD capability for \$300 or less (see What's Inside, facing page). Amazing! While none of the products, including AutoCAD, offer 100 percent 3-D capability, they're getting closer and closer all the

time 106 Complex CAD: Software for the PC 111 Hardware: Firm Support for CAD 151 CAD Support: An Embarrassment



SOFTWARE O&A: A Database with a Smart Interface Richard Aarons/When

Symantec Corp. of Cupertino. California, pulled aside the drapes and gave us a sneak preview of its new database manager last summer, we were impressed. Artificial intelligence it ain't, but that "natural language interface" is a good (and efficient) little

mover and shaker. Turns out there's more to crow about here than clever conversation... 185

Javelin: A New Modeler Takes Aim at 1-2-3 Jared Taylor/Can PC Magazine's hard-to-please chief 1-2-3 wizard and twicemonthly editor of Spreadsheet Clinic find anything nice to say about Javelin, the debut spreadsheet of a start-up company located in the same town as Lotus, the Colossus of Cambridge? Upon close inspection, and contrary to his First Look review, the answer is decidedly yes. Taylor also inspects the newest version of 1-2-3 213

> Getting the Most Out of Your Hard Disk

Stephen R. Davis/Hard disk speed demons are known for their nuthless singlemindedness when it comes to slashing access time. As any hard disk fanatic (read: 96 percent of all hard disk owners) can tell you, every millisecond counts. Which explains the appeal of programs like Lightning and Disk-



The IBM Token-Ring LAN: What? Why? Now? Frank J. Derfler, Jr., and William Stallings/No one seems to know quite what to make of IBM's new token-ring LAN. Will it repeat IBM PC history and become the standard 'round which other networks and related products rally? How does it work? Should you buy now, or wait and see? If anyone could find straightforward answers to these and a dozen other questions, our man Derf and "LAN master" Bill Stallings

could. And did197







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Building in Those Essential "Options" NEW ON THE MARKET Jim Seymour/Many options, David Obregón/What's new in now relegated to add-in cards half-sized 2,400-bos modems. will soon come built into the music editors, and hard disks on a card ...

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Cover Photograph: Gregory Cannon Cover Drawing: Ian Wornole

HAT'S INSIDI



PC Magazine believes in the collective unconscious. We even depend on it. Consciously. Except we usually refer to it as "editorial gut instinct." We depend on it to do things like determine how frequently we should write about editorial topics and product categories.

Every editorial subject has an

informal, more-or-less tacitly agreed upon frequency number. Spreadsheets, for example, are about a 5, meaning that there's enough new product introduction, upgrade of established products, and reader interest to justify a feature review of spreadsheets roughly five times a year (see page 213 for a review of Javelin, one of the newest, most talked about spreadsheets since 1-2-3 itself burst on the scene). Database management programs are also about a 5, or maybe a 6 (page 185: O&A from Symantec Corp.). Networks are at least a 3, but sometimes they seem like they ought to be a 12; there's so much going on. In this issue, Frank J. Derfler, Jr., and William Stallings explain (as opposed to review) IBM's token-ring network scheme (page 197), which needed explaining badly.

Most years, computer-aided design, the subject of this issue's cover treatment, has a frequency of 1. This low number may seem surprising for such an interesting, visually oriented product category, but the fact is that while CAD is always interesting, it has typically been regarded as specialized and "high-end"-the province of architects, engineers, draftsmen, designers, and sophisticated model makers.

You can imagine our surprise when, after meeting with our CAD specialist, Glenn Hart, we learned that a so-called CAD program, ProDesign II, was available for \$299. A couple of weeks later at a party PC Magazine hosted at Fall COMDEX, the big personal computer trade show in Las Vegas, Davis Straub, president of Generic Software Inc., introduced himself to executive editor Barry Owen and then handed him a program called Generic

CADD, which lists for \$99. Owen, Hart, associate editor Jennifer de Jong, and everyone else involved in the project were skeptical: A \$99 CAD? Hardly likely. But after Hart examined the two "low-end" CAD packages, which he expected to be more like drawing programs than true CAD tools, he was surprised and delighted to find that the CAD label was justified in both cases. What does this bode for the future development and marketing of CAD applications? We don't know, but if it looks like significant changes are in the wind, we're absolutely certain that PC Magazine's collective unconscious will clue us in. It always has before. Until this happens, you, too, can catch up with CAD, beginning on page 106.

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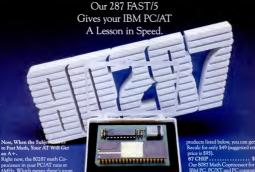
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ducks in a row.

a pie chart, a bar chart or a line chart. Filing Assistant data. Or all three. In minutes.

grams with plain English (TOTAL anyway instead of C21+D21+F21+F21), It's smart blank after "Dec 85" with "Jan 86."

Reporting Assistant helps you cre-

can see what the bottom line looks like as totals, subtotals and averages) of your

If you generate so many Writing Planning Assistant is a powerful Assistant files that you can't remember new spreadsheet that replaces the com- them all by name, there's Document make you feel more organized. For the plex commands used in earlier pro- Retrieval Assistant to help you find them location of the store nearest you and a

enough to widen columns automatically cation Assistant to do just what its name to fit your entries. It will even fill in the suggests: link your PC to your company's mainframe computer.

or directly from Filing Assistant, So you ate customized reports (complete with IBM Assistants cost less than \$150."

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LETTERS TO PC **MAGAZINE**



FASTLINK FAVOR Many thanks for M. David Stone's hands-

on review of the DCA FASTLINK 10Kbaud modem ("FASTLINK: Communicating at 10,000 bps and Up," PC Magazine, Volume 4 Number 25), and kudos to DCA for a clearly impressive product. But perhaps PC Magazine can put to

rest my nagging susnicion that the DCA modem may not be suitable for transmitting some non-ASCII types of files.

The technical explanation for the FASTLINK's performance centers on the use of 512 carri-

ers across a 3,400-hertz (long-distance) bandwidth. If I properly recall my sophomore engineering classes, modulating a carrier results in "sidebands" above the carrier frequency equal to the modulating frequency. So, putting 7 baud-which contains frequencies from 0.7 hertz to at least 7 hertz-on 512 carriers takes up all of the bandwidth available, but totals only 3500 baud. The only way I see to get 15 pounds of data in this 5-pound bag is for the modems to "presume" a certain content, such as text, and allow for probabilities, like frequently used letters such as vowels, or perhaps use shorthand notation for common words. If this is how this trick is truly done, it will not work so well for binary files. Did Stone try binary files?

David Kay Acton, Massachusetts

The discrepancy here comes from a confusion between baud rate and bits per sec-

M. David Stone replies:

ond, which are not always equal. According to DCA, the modulation scheme used by FASTLINK can encode up to 6 bits per baud. This means the theoretical maximum bits per second is not 7 baud times 512 carriers, but 7 baud times 6 bits per baud times 512 carriers, or roughly 22,400 hits per second. DCA says that because of the realities of line quality on the current phone network, it has limited the actual maximum instantaneous bas to 15.111 bps. This figure translates to a throughput, under good conditions, of slightly better than 10,000 bps.

It's also worth notine in passing that data compression techniques can work just as well with binary files as with text files. It's only necessary to encode the binary data on the transmitting end and decode it later on the receiving end. Although FASTLINK doesn't use such techniques. there are communications programs that do. A DCA spokesman says the company has tested some of these programs with FASTLINK to achieve effective throughput of 20,000 bps and better.

FIRST IMPRESSIONS

In Stephen Manes's article "Eavesdropping at the PC Party" (PC Magazine, Volume 4 Number 22), he writes: "Latest unmentionable: the recent discovery that the output from IBM's Quietwriter models is erasable, thereby facilitating unauthorized creativity on contracts, checks, and the like by their recipients."

When originally announced, the IBM Ouiet noncorrecting ribbon was not indelible, and IBM specified the ribbon should not be used with negotiable instruments. As of August 20, 1985, IBM has a new Quiet noncorrecting ribbon (reorder number 1299790) that provides darker, bolder print but, more importantly, is now indelible. This new ribbon replaces earlier noncorrecting ribbons and can be used not only with the Quietwriter Printer but with the Quietwriter Typewriter as well. We at IBM recommend the new ribbon for bank checks and similar documents.

C.F. Chamberlin IRM Lexington, Kentucky

EASYLINK PRICE CONFUSION While Barbara Krasnoff's description of

IN TOUCH OCISIDE WORLD



the EasyLink service in "In Touch with the Outside World." (PC Magazine, Volume 4 Number 18) was thorough and informative, one point needs to be clarified.

Instant Mail Manager software EasyLink 1 8 1 doesn't cost \$35 as reported. At the

time your article went to press, IMM was priced at \$95. There may have been some confusion over the \$35 EasyLink-usage coupon contained in each IMM package. Roy B. Anderson

> Western Union Upper Saddle River, New Jersey

TWO VIEWS OF SDI

I couldn't agree more with the concerns expressed by Stan Augarten about Star Wars in "Can Computers be Fail-safe?" (Computers in Society, PC Magazine, Volume 5 Number 1). The problem with Star Wars is much deeper than its technological pitfalls. It's the thinking behind it, as Augarten pointed out, that is ultimately dangerous. What is awry is our belief that

■ LETTERS

the arms race has been driven by technology and that, by extension, a technological solution will "save" us.

Once we have Star Wars, the exactingly complex problem of international relations will remain. What we'll have is a lot of incredible toys that cost a lot and do all kinds of amazing things. We'll have state-ofthe-art technology and hopelessly outdated thinking. We still won't get along with the Soviets and they still won't get along with us, because technology doesn't build human understanding. We might as well come to grips with that now before we decide to spend billions of dollars on something that probably won't work.

Marianne Allison San Jose, California

It is incomprehensible to me how someone as close to technology as I assume Stan Augarten is can be so blind to one of the basic principles of technological advancement: You can never do it if you don't try. Nearly every major accomplishment since the Industrial Revolution was achieved not because the "experts" of the day said it could be done but, rather, in spite of the fact that most of them were saving it couldn't be done.

I don't know if Stan Augarten was writing FORTRAN programs in 1962, but I was and I can assure you that any programmer would have doubled over in laughter and rolled on the floor if you had told him

 Comparing applications software to novels is like comparing oranges to motor scooters.

what he would be able to program and execute on a \$2,000 desktop machine in 1985.

If Augarten has a philosophical or political objection to the Strategic Defense Initiative, if he is afraid of unsetting the Soviet Union, or if he would just rather the Pentagon disappeared and the money be spent on social programs, that's fine and he's welcome to his opinion. But hiding behind the curtain of "technological impossibility" demonstrates blindness to his-

> Thomas W. Brower Savannah, Georgia

COPY PROTECTOR REPLIES

If consumers resented copy protection as fiercely as Bill Machrone proclaims ("Loose Ends," From the Editor's Screen, PC Magazine, Volume 4 Number 26), 1-2-3, which has always been copy protected, would never have made it to the number one spot in popularity.

Has it ever occurred to Machrone that copy protection is with us because there is a continuing and growing demand for it? Being against copy protection is like being against door locks, car keys, bolts, burglar alarms, and your friendly neighborhood cop. If everybody were totally honest and law-abiding, there would be no need for any of the above.

User groups resent copy protection until enough of their members become sufficiently proficient on the computer to write programs of their own; then they embrace copy protection with fervor. There is enough public-domain software available to satisfy the urge of amateur computer buffs to get something for nothing.

Comparing applications software to novels is like comparing oranges to motor scooters. But if novels could be copied by any joker in the street in 2 seconds flat for the price of a floppy disk, you would see some serious changes in the marketing of novels

The question is not copy protection versus no protection, but how to improve copy protection to accommodate the legitimate requirements of both software developers and users.

Cecilia Lutken Vault Corp. Westlake Village, California

Our business and professional readers may put up with copy protection of programs they need, like 1-2-3, but it doesn't mean they like it. Your analogy to door locks, car keys, and the like is faulty. The last time we looked, we bought these things to keep our own property safe from theft, not to allow its original manufacturer to keep us from making full use of it .- Ed.

BON APPÉTIT

Using applications programs is like using frozen dinners and prepared cake mixes, but programming is like using recipes and seasoning to taste. Would a fine chef serve frozen dinners? Would a fine programmer use prefabricated software?

Earlier this year you were publishing source code in assembly language. They were most informative to read and run.

 We'll be publishing both assembler and BASIC listings in

future issues.

Modifying them was educational. Now there's only a printout somewhere around page 200. Why not turn the clock all the way back and print it out in machine-language code?

Chuck Powell Pasadena, California

Though Betty Crocker might take offense at your analogy, we take it to heart. Once again, we'll be publishing both assembler and BASIC listings in future issues. We hope doing so will please every programmer's palate.-Ed.

CORRECTION

In "The Best of 1985 (and Some of the Worst)" (PC Magazine, Volume 5 Number 1), the Compaq Deskpro 286 was incorrectly listed at \$1,400. The correct price is \$4,244.

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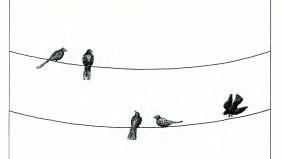


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PC ADVISOR

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ASSEMBLER HELPERS

I am finding it terribly hard to learn the IBM Macro Assembler. Do you know of any tutorials?

torials?

Robert Morton
Indio, California

This question called for an informal poll of PC Magazine's programming editors. The following books were deemed the most useful:

Assembly Language Programming for the IBM Personal Computer. bv David

Bradley (Prentice-Hall, (201) 767-5049; ISBN 013-049171-3; \$23.95).

■ Assembly Language Primer for the IBM PC, by Robert Lafore (Plume-Waite Computer Service, distributed by NAL

Books, (201) 387-0600; ISBN 0-452-25711-5; \$24.95). ■ 8088 Assembler Language Programming for the IBM PC, by David Willen and

ming for the IBM PC, by David Willen and Jeffrey Krantz (Sams & Co., (317) 298-5400; ISBN 0-672-22024-5; \$15.95). ■ 8088 Macro Assembler Programming,

 8088 Macro Assembler Programming, by Dan Rollins (Macmillan; ISBN 0-02-403210-7).

While these books will help you get upand running. The Peter Notron Programmer's Guide to the IBM PC. by Peter Norton, could help you leapfog into adverse of territory once you are (Microsoft Press, (260) 828-8000; ISBN 0-014885-46-2; \$19.95). It gives a thorough overview of intended to the program of the program of the cludder plenty of valuable tips on the best way to write asteroph language routines; and it even covers programming of the pripheral device, which most other books on the subject simply shortchange.

But you don't have to be writing your more programs to take advanage of the Macro Assembler. Every issue of PC Mag-riske's Programming Utilities column includes new and original assembler programs. When an expecially long engrams. When an expecially long presented, we don't print the program, but if you send a self-addressed, stamped envelope, we'll mail it to you. The discussions and extensive comments that accomments are programs and the programs are programs.

APPLE-IBM FILE SHARING

I own an IBM PC AT and an Apple IIe. I have over 60 Apple disks filled with word processing stored in binary, writen using Pie Writer from Hayden. I want to transfer these disks to the PC AT for use with Word Perfect 4. I from Satellite Software. I would think there are a number of others in

 Far easier and more sensible for

connections between office IBMs and home Apples is modem transmission.

my boat, having Apples at home and PC ATs at the office. In the PC Advisor of October 29, 1985 (PC Magazine, Volume 4 Number 22), you recommended Quadram's Quadlink, but since it's incompatible with the PC AT, that's our. Besides, I don't need another expansion board or serial nort.

> Charles D. Ray Wayzata, Minnesota

The Quadlink boord is the best way to link a PC or XT and an Apple II or II+ because not only can you mave files, you can share software programs between them. But as I mentioned last October, it's not compatible with the AT and the II-

Sharing files between the Apple II series and an IBMP C. X. AT. or even a gis into a major problem, thanks to the ASCII stam-dard, which all accept. The fact that your Pic Writer files are stored in bishary is of file. The problem is the problem of the problem is companier, which was a companier, but the fact that Pic Writer text files are in SACII is a head star. Deat files that aren't would have to be translated. Word Perfect is not in ASCII, the in readily accepts incoming ASCII files and translates text files are from the problem in the problem in the problem is not in ASCII, files and translates text for manufactory way of the Sace DOS Text granutation by way of the Sace DOS Text granutation by way of the Sace DOS Text granutation by an or the problem is the problem in the problem in the problem is the problem in the problem in the problem is the problem in the problem in the problem in the problem is the problem in the problem in the problem in the problem is the problem in the problem in the problem in the problem in the problem is the problem in t

The best way for you to move files between the two machines depends on haw much you can spend, how often you plan to do this, and whether you plan to transfer more-complex data in the future.

It's possible to connect an Apple II to a PC with standard RS-232 cable (also known as a null madem) and send ASCII



files without any special software, but you may need to rewire the cable at one end to match the configurations of the other computer depending on the models you're connecting, and you would have to have the two machines in the same room. Not practical in your case.

Far easier and more sensible for connections between office IBMs and home Apples is modem transmission. Any Hayes-standard modem will do the trick. You could transfer ASCII files without any special software, but you'd need two modems and somebody attending the other computer. Unattended transfer requires a different approach.

If you'll be doing this only infrequently, you can get away with just one modem by using MCI Mail as the go-between. Subscribe at both home and office (call (800) MCI-2255 for rates, which vary depending on the service ordered). Mail a letter to yourself, and then cart the modem to the office when you're ready to receive it. MCI holds your e-mail until you call for it.

By the time you've sent your 60 disks via MCI Mail, though, you may have spent enough to buy an extra modem and two copies of Crosstalk (Microstuf Inc., Roswell, GA 30076; (404) 998-3998; \$195), one for the PC AT and one for your Apple. Crosstalk is a communications program that allows unattended transfer of files. Leave it running on your office AT and call from your Apple or vice versa.

If you plan to send more-complex, non-ASCII (binary) data, such as spreadsheet or database files. File Transfer Conversion Utilities can make the process easier (Personal Computer Products, Santa Clara, CA 95054; (408) 988-0164; \$149; \$224 if you need the 9-bit plug to link the PC AT and the Apple via cable). It will strip out code used by your software in formatting ASCII files and can translate binary files. The drawbacks: It goes only one way, from the Apple to the PC, and it needs attention at both ends to send more than one file at a time. But it does come with utilities that clean up files you transmit via other communications software.

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But now comes BASIC_C and all your print using, clear screen, "instr", on error goto ... they're all there. Some have reworked names and symax to sur C, but all are written as one-to-one functional educalents to the familiar features of BASIC And they are documented one to a page in alphabetical seguence life the Micros

manual for added familiarity. So with BASIC_C, when you're thinking INPUT go shead Use it. Or LPRINT or LOCATE or INKEY But without BASIC_C. you will find that every line of code plunges you back in the C tests to figure out how to write it Someday you'll want to but for now BASIC. C will start you program-

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interface to a library, using the Lattice compiler (a mail!). How about your own archive of functions? No reason why not The RUN/C Interpreter

The interpreting engine lies at the heart of both the improved original RUN/C and the new Professional version. His creators had the insuration to make once formidable C behave on screen much like PC BASIC with a full-screen editor like WordStar* Just crease a program and RUN s. If s stumbles, LIST s, EDIT s, add lines, delete lines, RUN s again, fix s agai Use familiar commands like LOAD, MERGE, SAVE, FILES, even TRON and RACE, and a free profiler RUN/C is ideal for rapid to development. Put up code at high

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RUN/C Standard Version Straight RUN/C has all above but the oadable Libraries PM docking module

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CTM to its leadership role as the C Lattice now embraces key UNIXTM RUN/C Pro has every feature of RUN/C regular plus the binary library guage since Kernighan & Richie -

RUN/C regular plus me bussly more, link up and an extra level of debugging aids. They are ingeniously installed behind a bust-in function, so you can call for debugging conditionally. The called void functions returning no value, enum ues to variables, the ability to pass data nal function arguments by data type as proposed by ANSI to kill bug swarms when modules our up at link time. The greatly expanded libraries, now comprising 325 functions(!), enable the step tracing, and changing of variables. front end to feed a continuous stream of implement of transcendentals, and a Only the source work in progress is still interpreted, the finished modules will

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a single command may repre

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IBM Targets RISC PC for Engineering and Graphics

Part minicomputer, part personal computer, the 32-bit RT PC is for users with heavy-duty computing needs.

BY BILL MACHRONE
NEW YORK—IBM's new RT

NEW YORK—IBM's new RT
PC is (pick one):

• A graphics/engineering
workstation

A multiuser UNIX system
 A hot replacement for the
PC AT.

If you picked all of the above, you're wrong. It certainly is the first two, and it's certainly not the third.



IBM's RT PC desktop version runs a UNIX variation and offers a DOS option

The RT PC uses IBM's new RISC (reduced instruction set computer) architecture, a proprietary 32-bit chip with memory management. It packs 4 megabytes of main memory and can address up to a trillion bytes of virtual memory—clearly a chip with a future. An optional floating point ascelerator gives new life to your calculations as well

AIX: UNIX Derivative

The RT PC's new AIX operating system is based on UNIX System V, but IBM spokespersons claim that they've added as many lines of code as were in AT&T's original version of System V in order to make it more powerful and easier to

..............................

Hooked On the First WOR

drive makes userwritable optical storage a reality

FIRST LOOK

BY CRAIG L. STARK
NEW YORK—Sliding back to
protective cover on the cartridge, I could see a thin band of
iridescence on the mirrored surface of a 5-inch optical disk.
Less than an eighth of an inch
wide, that stripe was the

Bible—4.7 megabytes of Old and New Testament. And 110 megabytes were left over on the disk, for God's afterthoughts or man's databases.

The Isl (Information Storage Inc.) 252 WC Optical Storage System is no longer a technology with tantalizing potential, but a product you can buy, put on your deak or in your PC, and use to store up to 115 megabytes' worth of files per (removable) disk side. It occupies a standard S'-inch, full-height form factor, comes with a half-form factor, comes with a half-form factor, compatible), and is supplied with fully DOS-compatible.

software. Though not intended for total computer novices, the instruction manual is remarkably clear and adequate for a moderately advanced user.

moderately advanced user.

Unlike a CD-ROM, whose
contents must be recorded by an
off-site manufacturer, the 252

WC lets you write your own
files to the optical disk whenever
you wish. Like those on a
CD-ROM, the file is permanently recorded, once writen,
as a series of laser-bursed
"pits" on the reflective surface
of the disk moderate is not to the
order of the control of the
wish of the
wish



Each \$60 data cartridge for the ISI optical drive holds 115 megabytes. Data are visible as thin stripes on the surface of the plass disk media.

RISC PC

use. One of the IBM-added features is the ability to run DOS as a task under AIX, with help from an optional 80286 coprocessor card. IBM also included key features from Berkeley UNIX 4.2

(continued from preceding page)

The RT PC comes in two bases flavors: desktop and floorstanding. While the processor is the same in both, the floorstanding model can hold more memory and can support more users simply by having more slots. It can also accommodate three hard disk drives of up to 70 megabytes apiece. The desktop model starts in the \$8,000 model starts in the \$8,000 weight in at around \$12,000. With options and software, prices can double.

IBM introduced the RT PC with a wide variety of displays. Two monochrome graphics displays figure heavily in the RT's appeal to program developers used to working with oversized screens running multiple graphics windows on workstation products made by Apollo, Sun, DEC, and others. The 6155 Extended Monochrome Graphics Display has a 15-inch screen

INITIAL TESTS: THE IBM RT PC

	RT	AT	AT&T 6300 Plus
256K	4.61	3 07	2.10
64K	4.33	2.85	2.00
gones conventional on ATs and compati soft specification st when the entire con-	d essesses the speed of il memory on PCs XTs. bles and expanded me	and compatible mory conforms the conventor machine's me:	es expanded memory ng to Lotus Intal Micro- trial memory was tested mory in block sizes of

Disk Input/Output 512 Bytes
RT AT A

01 25% Records from the created detaile to rowed by a sequential read of the same records

1-2-3 Routine

RT AT AT&T 6300 Plus

78 95 72

1-2-3 Routine (BENCH13 WKS).
This is predictived approach on benchmark legt assesses the computational speed on the production of the motione by soring a 1-2-3 matter that containing the production and production and production of the motion of the production of t

With a SP95 AT processor board opinion installed, the RT PC bessed both a standalone IBM PC AT and an AT aT PC 600 Plus to some of PC Magazine Label standard benchmark stass. Although the RT lagge obvining the AT and and 1600 Plus as so done obvining the AT and and 1600 Plus as so done coase, results are najbect to change because the RT tests were not run under normal. PC Magazine Label soppowed (revensations. For instances, the And disks (IBB) - demonstration machine had 70 megabyte Micropoliu anus) should have been erased and formanded view to the 1sts. Label to moderate RT PC between it in a future view.

and 1024 by 750 resolution. It outshines even the new Advanced Color Graphics Display, which can display 720 by 512 pixels in 16 colors. A 12-inch monochrome monitor is more suited to system console applications and can emulate the PC's Color Graphics Display or the standard monochrome displayed.

play.

If that isn't enough to convince you that IBM is serious about the workstation market, it has introduced a new version of the magnificent 5080 CAD workstation, which used to require a mainframe. Now it can run standalone with an RT PC.

Desktop Minicomputer

The RT PC is truly a desktop minicomputer. It has a 32-bit memory bus, with a full errorcorrecting code (ECC) byte for each 32-bit word of memory. Error correction is what grownup computers do with memory. as opposed to the PC's puerile parity checking. The motherboard handles both RT 32-bit cards and PC AT 16-bit cards. The RISC processor is not on the motherboard but on a card that plugs into it. Likewise, the memory cards plug into the 32bit bus. The motherboard is pri-

First WORM

ticated servo control system. To update a file you must write it anew, though you can read any file as many times as you want. Hence the unlovely acronym

WORM: write once, read mostly. The system read-defaults to your most recently written version of a file, though you can

ou want. override the default.

WORM devices are not intended as a replacement for hard (or floppy) disks. According to at least one study, however, aproximately 70 percent of the contents of a typical hard disk consist of permanent files that could be taken off the hard disk and stored on the optical. The permanence (I o' years is currently specifical) is for many than the contraction of the contraction of the contraction of the both in terms of maintaining and both in terms of maintaining and the possibility of destructive

head crashes.

Easy Insertion
The optical media for the ISI

525 WC are manufactured by Sumitomo and Daicel, both of Japan, and are preformatted and certified for 115 megabytes per side. The carridges are as easy to insert and remove as floppy disks and are far less fragile. Up to 65,535 files and directory en-

tries can be made, grouped into as many as \$11 sets that somewhat resemble DOS subdirectories. Up to 63 files may be "mounted" simultaneously, subject to the DOS limitation that no single data request may exceed 32 megabytes.

On any kind of cents-per-megobb basis, the cost of the ISI 525 WC is remarkably low-32,495 for the single-unit "evaluation kit" described here, considerably less for OEM-size orders. (Franklin Telcom and Buckpac International are also offering the unit in VAR form.) Single-sided disks cost 506 cent—52 cents a megabyte—or \$100 for a doube-sided "dimu."

The ISI 525 WC will certainly not be the last WORM system designed for use with the PC, but it is the first to be up and running, in daily service. Here at PC Magazine we'll be giving it (and any available competitors)



The ISI 525 WC optical disk drive comes in a freestanding cabinet or fits in a ssandard 54-inch drive slot in a PC. The controller card fits in a short slot.

marily responsible for converting the signals and timing from 32 bits to 16 bits and providing system services such as DMA

and clock signals. If you want your RT PC to run DOS programs, you have to plug in an optional 80286 coprocessor board (\$995). If you want it to run fast, you must also purchase a dedicated memory option that allocates 512K bytes to the 286, instead of having to borrow it from the RT's host processor. How fast is fast? About 80 percent of a PC AT The early rumors about the RT being a super AT were wrong.

IBM is backing up with software its claim that this is a minicomputer. Many popular UNIX utilities have been ported over, as has IBM's SOL multiuser database software.

Graphically Speaking The RT PC pulls out all the stops when it comes to graphics support. The IBM Professional Graphics Series, Professional

CADAM, Personal graPHIGS (programmer's hierarchical interactive graphics system). CIEDS (computer-integrated electrical design system), and UNIRAS (color graphics display and manipulation) are

a full lab-test review as soon as practicable, but, after a first look, at least one editor I know isn't about to let it go.



ISI 525 WC Optical Storage System Information Storage Inc. 2768 Janisell Rd. Colorado Springs, CO 80906 (303) 579-0460 List Price: \$2,495 (evaluation kit), Media: \$60, single-sided; \$100, double-sided Requires: 128K RAM, DOS 2.0 (or later). In Short: The first working WORM optical disk system for internal or external PC

mounting: with 115 Mbyte

capacity.

among the offerings.

The RT PC can support up to eight ASCII terminals, timesharing with the host under AIX. Traditional minicomputer users will understand the multiuser flavor of the initial software offerings. All 12 Solomon III accounting applications are available, as is Applix IA, best described as a blend of SideKick and Framework for UNIX machines Samna Corp. has ported a version of Samna+ to the RT, and Interleaf offers its spectaculas Workstation Publishing Software. RS/1, a high-end data collection and manipulation in-

tegrated package, can be teamed with IMSL's library of more than 500 business/scienti-

fic Fortran routines Pascal, BASIC, and Fortran compilers make full use of the new RISC chip. They run under AIX and can be used to develop custom multiuser applications programs. Meanwhile, AIX itself supports all the usual UNIX productivity tools.

If you've read this far, you're convinced that IBM is serious about this product. Two years after the fact, IBM dignified the 32-bit workstation market with its presence. Twenty years after

Tape backup remains one

area where the PC's industry

competitors-most notably

Compaq, with cartridge backup

built into its Deskpros-put

IBM at a competitive disadvan-

gabytes, with a maximum back-

up rate of 5 megabytes per min-

utc. IBM says 40 megabytes of

data take a real-world 15 min-

Cartridge capacity is 55 me-

the fact, IBM has entered the ASCII-based minicomputer market. The key is that it did both with the same machine.

The RT PC is an alternative to many small multiuser systems. It's not cheap, but it wears the right nameplate. On one hand, it's aimed straight at the hearts of the Sun and Apollo genre of workstations. On the other, it's aimed at the low end of DEC. Data General, and Hewlett-Packard sales. The RT PC also will take some sales away from the System/36, but what's a little cannibalism if you keep it in the family?

IBM Unveils Plotter and A Tape Backup System slots rather than the 32-bit RT

tage

BY BILL HOWARD

NEW YORK-While the day belonged to RISC computer technology, supporting hardware with the ability to link to the IBM family of personal computers was also announced at IBM's January 21 press conference, including famousmaker products with IBM's label affixed.

The most-PC-compatible product was the 6180, a \$1,285 six-pen color plotter for A-size (81/2 by 11) paper. It's the spitting image of Hewlett-Packard's \$1,295 7440 Color Pro. except that HP includes both RS-232 and IEEE 488 interfaces in one unit while IBM makes you choose one or the

The IBM 6180, due in March, replaces the two-pen IBM 7371 (\$1,100). It supports the industry-standard HP-GL interface

Tape Backup-at Last Also shown was the IBM Model 6157 1/4-inch Streaming Tape Drive. While the \$1,795 made-for-IBM units interface with only the IBM RT PC, the System/36 PC, and the System/36 minis for now, connecting them to PC-XTs and ATs might be a future possibility. On a demonstration RT PC, the interface board was nestled in one

of the eight PC AT-type bus

ported.

utes to back up. Both file-image and file-by-file backups are sup-Third-Party Software Following the IBM an-

nouncement, software developers wasted no time in announcing compatible products.

Oracle Corp. of Belmont, Calif., says a version of its Oracle database will be marketed by IBM as SQL/RT.

Graphics Software Systems of Beaverton, Ore., announced a set of graphics development tools for implementing its GSS Virtual Device Interface on the

RISC Technology: Elegant Simplicity

What is RISC (reduced instruction set computer) technology? It's the computer world's way of saving "less is more." And faster. While most microprocessors can execute 200 to 300 different instructions-such as add, subtract, shift, and compare-the 32-bit chip in an IBM RT PC executes but 118.

Because they're relatively simple instructions, the RT typically executes them in one processor

pulse, a speedy 170 nanoseconds, or 170 billionths of a second. The more complex instructions of non-RISC processors might take several pulses to complete and use two to four times as much time, an IBM spokesperson says.

The reduced instruction technology isn't the sole reason for the RT's speed, IBM cautions Efficient memory management and the "pipelining" of data into the processor also play key roles.

-Bill Howard



Close inspection of the 32-bit IBM RT PC microprocessor shows that it's 7.65 millimeters sausre-less than a third of on ench square.

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tor in 16 shades

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NEWS IN BRIEF EDITED BY JANE MINTZER

Xerox Network Xerox Corp. of Rochester, N.Y., has announced its XC 22, a local network for microcomputers running MS-DOS 3.1. The XC 22 is software-compatible with the IBM PC network and IBM Token-Ring network. The cost is \$720 per workstation, far less than Xerox 5 Ethernet network.

The XC 22 connects one hard-disk-equipped file server to other workstations over standard twisted-pair telephone wire at one



The Xerox XC 22 is built with AT&T's Starlor network technology, It is software-compatible with the IBM PC network and Big Blue's Token-Ring net-

ted-pair telephone wire at one megabit per second. Workstations are connected through a specially wired telephone jack or daisy-chained through standard wall jacks.

AT&T's Starlan network technology makes the high-speed transmission possible. The XC 22 is one of the fruits of an agreement reached last April between Xerox and AT&T that allows Xerox to market Starlan network hardware.

The XC 22 is available now. For more information on the company's products, contact Xerox Corp., Xerox Square 006, Rochester, NY 14644; (716) 423-5078.—Christopher Johnston

PC AT for Retailers . . . IBM has announced the IBM 4680 Store System—a retail point-of-sale (POS) system designed to be used in department stores and for mass merchandisers. The new system includes modular IBM 4683 point-of-sale terminals and two versions of the IBM PC AT that will act as the in-house system controller for use to 128 store terminals.

The AT Model 899 with once or two 20-megabyte hard disk drives stars at 89, 20, the AT Model 89 with one or two 30-megabyte drives starts at 89,320. A salesperson can use the terminal to committeate with the controlled to check merchandise prices, suthorize credit, or store one transaction and start another. The terminals allow concurrent communications with the POS processor using asynchronous, binary synchronous, or IBM 's Systems Network Architecture/Synchronous Data Link Control protects."

The system runs under the IBM 4680 operating system that can emulate PC-DOS, allowing an AT to be used as a personal computer when it is not being used as a controller. Keyboards, cash drawers, and register printers and displays for the POS terminals are available separately.

PCs Go to the Malls . . . Small or medium-sized retail businesses might appreciate Armor Systems line.'s retail management systems, Brawer For \$69.98, Brawol lets an IBM FO, XT, AT, or compatible act like a cash register, as well as offering retailers other accounting functions such as inventory control, accounts receivable, point-of-sale terminal, and billing. All of Brawor's functions can be performed simultaneously.

Bravo! requires 256K bytes of memory, a 10-megabyte hard lisk, a PC-compatible cash drawer, and a 40-by 80-column printer. Depending upon the hardware and operating systems used, Bravo! can support up to 12 workstations. Armor Systems Inc. is located at 324 N. Orlando Ave., Maitland, FL 32731; (305) 629-0736.

Carry a Gold or Silver Card . . . Two new high-resolution, shagle-slot graphics cards aimed at computer sided designers are available from QDP Computer Systems. The \$1,295 Viva Silver Card offers CAD software users high resolution and support for any IBM PC-compatible color monitor. It upgrades the standard two-color, IBM PC 640 by 200 resolution to 16-color, 640 by 400

resolution.

The Viva Gold Card is for the professional CAD system user and features 16-color, 1,024 by 1,024 resolution. It supports any RGB

analog monitor.

Bill Feony, vice president of marketing for QDP, says that the
two Viva boards are "for vertical applications involving CAD, they
are not just regular high-resolution cards." Both cards are compatible with software written for the NEC 7220 chip, including Auto(AD)

QDP Computer Systems is located at 10330 Brecksville Rd., Cleveland, OH 44141; (216) 526-0838.

Latest BPI Software . . . BPI Systems, Austin, Tex., is targeting its Enterprise accounting and records management software series at the medium-steed business market. At present, Enterprise includes general ledger, accounts receivable, accounts payable, and payroid at \$795 cab. BPI plants to add order entry, report

writer, and inventory control modules later this year.
All told, the Enterprise series occupies 3.5 megabytes on an IBM
PC-XT or compatible and adapts to system networking. Features include look-up windows, context-sensitive help, a chart editor, and

application access from within other applications.

Though users may create their own financial sheets, 80 standard accounting and management report prototypes are included.

BPI Systems is located at 3001 Bee Cave Rd., Austin, TX 78746; (512) 328-5400. —Christopher Johnston

LaserWriter Plus Debuts . . . Apple's LaserWriter Plus printer increases the number of built-in fonts available from 4 to 11. The LaserWriter Plus is an updated version of the laser printer that was voted Editor's Choice by the editors of PC Magazine (Volume 4 Number 6). It will be available in March and will cost 56,798. Owners of the \$5,999 LaserWriter can buy an upgrade kit for \$7599 in March.

Both LaserWriters have an 8-ppm Canon LBP-CX print engine and Amotorola 66000 processors, 1, 3 megaphyses of RM for 8300-by 300-80-eper-inch neolosition, and effect Times, 14 feeterlas, Costribution, 2000-2000, and 10 feet Times, 14 feeterlas, Costribution, 2000-2000, and 10 feeterlas, 10 feeter

In a separate announcement, the Cupertino, Calif. -based companyu neviled its Macintosh Plus, which for \$2.599 includes I meabyte of RAM and a keyboard with numeric keypad. Apple has also reduced the price of the existing \$12K-byte Mac from \$2.495 to \$1,999.

ITC Bookman Light ITC Bookman Light Rate ITC Bookman Demi ITC Bookman Demi Italia New Century Schoolbook

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Roove, print samples of flow of the seven available from now available with Apple LaserWriter and LaserWriter Plus printers.

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And of course, it's fully compatible with all programs with undersemed of speed!

A Tale Of Three Mice . . .

Compare our Mouse with the others running around and you'll see, there's no comparison! Here are just a few features across the board:

FEATURES	Maynard	Micro-	Mouss
	7	3	6
Button Auto Recest	Yes	No	No
Discreetics	Yes	No	Yee
Dynamic Scaling	Yes	No	No
Cursor Overshoot Control Adjustable Cursor Speed Up, Dn (white	Yes	No	No
running application) Adjustable Cursor Speed Rt. Lft (while	Yes	No	No
Dipping application)	Yes	No	No
Buttone-Definable (while running application)	Yes	No	No
Macros-Definable (while running application)	Yes	No	No
User-Defruable Atternate Cursor Movement	Yes	No	No

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The WordStar MicroPro Won't Sell in the U.S.

PRODUCT REVIEW

Available only outside of America, the foreign

WordStar 3.40 is mostly a mirror of its red, white, and blue cousin

BY STEPHEN MANES

For a year and a half, rumors trickled in from Englond. The Holy Groil-a superversion of WordStar-wos sighted in Hartford, Hereford, and possibly Hampshire, Truth or ale? We put our not-so-young Sherlock on the case. His no-nonsense report

Subject: WordStar 3.40. Availability: British Isles and other European venues but not the U.S. Grail? Hardly; just old WordStar with a minor facelift and a smattering of new fea-

Most obvious? Cosmetic surgery. Menus look more streamlined through use of extended character set. Arrows and deltas improve logic of right-hand "flag" column, though irritating bright bars replace former serene blankness. Ruler line no longer matches what you must type in to change it via Ctrl-OF. Biggest surprise? Accessibil-ity of extended character set via

Alt key combinations. For accented and similar characters on printers that lack them, new Printer Compose Table allows you to redefine any output character as an overstruck combination of two

18 Function Keys

Function keys? Now 18. complete with bottom-line display. The uncustomizable F10. called More, toggles between two sets of function key definitions. Also newly implemented,

six much-wanted Ctrl key com-

New commands? Three, all omitted in on-screen menus. Ctrl-Q1 and Ctrl-QH change case (upper or lower) of word or line. Ctrl-OG controls direction of this function; status is indicated by displaying current filename in case to which text acter and equivalent character quo character? Elementary: It automatically precedes the character-as-character in the file with a bex 1B (Esc) and follows it with a hex 1C. Send such a file to another WordStar user and all bets are off when the program gets to the fancy characters-unless the other user also has WordStor 3.40. Conversion

utility and extra print-to-disk

function produce files useful to

DOS and other programs friend-

ly to high bits, making this ver-

sion useful for box drawing and

the like. No full WS-to-ASCII



For European eyes only: WordStar 3.40's on-screen display mode of underline

boldface is toggled using Ctrl-OD. will be changed or altered. Long-awaited on-screen display of underlining and boldfacing virtually useless. Familiar 'S and B present until display mode toggled with Ctrl-OD. Then text appears underlined and/or boldfaced. Sort of: If emphasis extends for more than one line, first line is emphasized on-screen and blinking character appears in flag column. Line containing requisite "stop emphasis" character then shows

sized and vice versa Program displays spaces between words as underlined: however, it still refuses to do this automatically at print time. Trick of searching for print control characters by entering their high-bit counterparts from the Alt key combinations no longer

unemphasized text as empha-

works. How does 3.40 distinguish between Ctrl-S underline charstripper is included.

Cursor can be changed from underline to block at installation, but color and highlighting still limited to one combination for text and one for menus. Setting un monochrome screen in former PC default mode-highintensity text and normal menus-means program won't display its guesses regarding boldfaced text. May be just as

Hard to Customize

WordStor customization junkies will need sleuthing talents. Some published patches (delays and screen colors) still appear at same addresses. Others (printer patches) have been moved. Still others (function keys) changed beyond easy recognition. Only the very shrewd will feel confident modifying areas of the program inaccessible to official installation proce-

Subdirectories and paths are still not supported: Enter one and you may find yourself staring at DOS prompt after losing unsaved text. Companion version of CorrectStar designed for British English: Flags color but not colour. (American 3.31 dictionaries seem to work just fine with 3.40 CorrectStor overlay.) MailMerce conditionals first sighted in 3.31 are not implemented here.

Any reason to consider this version of WordStar? Only if you would kill for an extended character set. Search for the Grail continues.

WordStar 3.40: Not for the Colonies

Developed by MicroPro Ireland specifically for the European ma ket and released in September 1984, WordStar 3,40 is offered in English and eight foreign languages. It is not available in the United States, and Canadians can buy the 3.40 edition only in French. According to MicroPro spokesperson Wink Grelis, the update

was not released here because "the ways in which the product is substantially different are relatively minor." And work is proceeding on a fully revamped version. "Resources have been allocated, the spec is finalized, and development people are working on it," says Grelis, but no date has been announced for the new release. MicroPro won't supply WordStor 3.40 in America. Those in

need of its features are directed to MicroPro's British distributors. including First Software and Softsel Ltd. in London. The list price for WordStar 3.40 is £295 (approximately \$425 in United States currency). The Professional pack, including WordStar and the requisite 3.40 versions of the add-ons, lists for £399-about 575 Yankee dollars.

"The Emerald Mainframe-to-Micro subsystem saves us \$6000 every month."

avid Speelman always has a smile on his face when he's talking about the 1/2 inch tape subsystem he purchased from Emerald Systems. He should smile. The subsystem helped him increase his office's monthly revenues by \$50,000.

David is VP of Datacopi, a San Diego company that provides hard convoutnuts of mainframe data. Often that data must be "massaged"

before it is usable by the big Xerox 9700 laser printers "Data usually comes to us on reels of 1/2 inch tape that

are generated by a mainframe computer. The Emerald subsystem lets us manipulate the data on those tapes with an IBM AT and be printing within the hour-at a fraction of a service company's fee." (Datacopi has reduced service bureau fees by \$6000 per month.)

"The system's speed is comparable to the speed of the computer at the service bureau, but now we don't have to move tapes around or wait to get on the computer. We cut our lead time from 24 hours or more, to as little as an hour.

Best of all, we have more control over the final format-a few key strokes on the AT changes the output to exactly what we need. And, because a large percentage of our customers are repeats who run similar jobs on a regular basis, we can write batch files. Next time that customer comes in, the

David found an unexpected benefit in the new subsystem; his company now uploads DOS files for customers, to take advantage of the great speed and graphics capabilities of the \$1/2 million Xerox laser printers. "That's a whole new area for us. The ability to upload PC files, the additional control we have over

AT, the batch file and the Emerald

subsystem do all the work.

mainframe tape downloading and the reduced turnaround time has given us a distinct 'edge' in our market.' beams David. (Datacopi has converted this "edge" into \$50,000 a month in additional revenues.) Datacopi uses an IBM PC/AT, an Emerald 70 MByte hard disk

subsystem and an Emerald Mainframe-to-Micro 1/2 inch tape subsystem, to accomplish these modern day miracles. The entire system was purchased for under \$20,000 and supports 3 Xerox 9700 laser printers on a daily basis.

smile on your face.

The Emerald Mainframe to Micro 1/2 inch tape subsystem also offers advantages over 3270 emulation

techniques. For example, it's up to 100 times faster than emulation. And, because access is limited to data on the mounted tape, it's more secure. So, if you're looking for the alternative to service bureaus and emulation techniques, or if you are a service bureau, call Emerald. We'll put a

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PC UPDATE BY VIRGINIA DUDE!

Symantec Corp. of Cupertino, Calif., has shipped Version 1.1 of Q6A, a natural-lanquage database management system that is integrated with a word processor. Version 1.1 includes a disk-based spelling checker, improved import/export capabilities for floppy disk systems, enhanced search and replace functions, and double-line box drawing. Updates are free to registered users. Symantec is also offering Q&A bundled with a 256K RAM memory board for \$349 through March 1986.

Western Union of Upper Saddle River, N.J., has introduced Version 2.8 of Basylink Instant Mail Manager, an integrated communications package that interfaces with Western Union's Easylink data communications service and also stands alone as a communications program for the PC. Version 2.8 has increased address list functions that include temporary mailing-list capabilities, improved address list maintenance using a new scroll feature, and full compatibility with dBASE II and III. Por a free update, send the original program disk and packaging to Kensington Microware Ltd., 251 Park Ave. South, New York, NY 18818. Add \$35 for new documentation.

Microsoft Corporation of Bellevue, Wash., has released an updated version of the Windows Software Development Kit. When combined with a programming language com-piler, the kit has all the tools needed to write applications programs for the Windows operating environment. New features include an enhanced programmer's guide and a more detailed reference guide. Also added are enhanced programs that allow developers to take greater advantage of Windows' user interface and graphics features. Updates are \$75. Registered users call (206) 828-8088.

The Software Group of Ballston Lake, N.Y., has released Enable/Check, a spelling checker designed to work with the Enable integrated software system. TSG will send free copies of Enable/Check to Enable users who subscribe to its annual support plan. Other users may buy it directly for \$34.95. If you subscribe to TSG's support plan for \$95, you will receive a free copy.

Winterhalter, Inc., of Ann Arbor, Mich., has reduced the price of SECUREI, a PC data protection system, to \$325. SECURE protects data on hard and floppy systems from unauthorized access, and uses the U.S. Government-approved Data Encryption Standard (DES) algorithm to encrypt information into an un-readable, undecipherable code. Winterhalter has also made SECURE! Master Rey, a central-ized control password replacement version, available on an individual basis for \$475. This version lets users access protected data if the employee loses the password or leaves the organization without decrypting the files.

Short Takes: Chesapeake Data Systems Corp. of Columbia, Md., announced price reductions on its line of PCs and XTs. The singlefloppy PC with 256K is now \$1,498; a hard-disk unit with 512K and 28 megabytes of storage is \$2,995. Chesapeake's dual-floppy and 18-megabyte systems were reduced to \$1,658 and \$2,395, respectively ... Xidex Corp.'s Dysan Interrogator floppy disk drive test package now supports AT&T, Compaq, Commodore, Data General, Kaypro, and Tandy computers ... Softcraft Inc. of Madison, Wis., has upgraded Pancy Pont, a font package, to run on laser printers. It offers several font sizes and styles, plus a character database for creating custom designs. Updates are \$25 if the upgrade is for the same computer as the original.

PC Update reports on software and hardware enhancements. To contribute, write or call Virginia Dudek, PC Magazine, One Park Ave., New York, N.Y., 18816 (212) 583-5265.

Timeslips Keeps Tabs On Hourly Services

BY GLENN HART

If you're a consultant, lawyer, engineer, advertising agency-any individual or company whose services are billed by the hour-then you're losing income by not keeping accurate records of time expended. Without such records, you may not know where all the time goes, whether your rates are appropriate, which partner is not pulling his weight, or who is generating the most income If these operations sound like something well suited to a computer, you're right. Timestips is a general-purpose time-billing package suitable for a wide range of time-oriented businesses. Timeslips resembles a database management system in that data files storing information on staff members-such as their various billing rates, activities and time spent, client names and addresses, and so forthare created and maintained.

Interactive Billing

Most time-billing packages are batch oriented. Timeslips can work this way too, but it also has a much more interactive method where every action, from entering time spent to creating productivity reports and client bills, is selected from onscreen displays. The system even includes a timing program that can run in the background and track the actual time spent on a project to the second.

Timeslips's screens are complex but well organized. Excellent context-sensitive help and informative prompts make the program almost self-explanatory. The reports and invoices created by the system are good. although some competitive packages offer a broader range of reports.

All in all, Timeslips is an elegant method of tracking time; a

wide variety of businesses can use it to good effect.



North Edge Software Corp. P.O. Box 286 Hamilton, MA 01936 (617) 468-7358 List Price: \$95.95 Regulres; 256K RAM, two disk drives. In Short: A general-purpose time-billing program with notable on-line help. More interactive than competitive programs,

with interesting methods.



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CIRCLE WILON READER SERVICE CARD

If you don't have data worth preserving, then the reasons for buying Cartrex's new ¼-inch, high performance, virtually error-free tape cartridge won't mean anything.

But, if you are one of the many ¼inch tape cartridge users that assume 3M's cartridges just have to be "good enough" for today's high performance tape drives, read these simple facts to understand why that isn't true anymore.

Why a new cartridge

With the significant increases in tape drive capacity, system reliability demands a tighter tolerance cartridge. Most tape drive users aren't aware that all of the tensioning, tolerance, and data reliability issues are vir-

tually all a function of the tape cartridge.

When 3M announced its cartridge in 1971, it was designed for a low capacity tape drive with less than 3 megabytes—2.88 to be exct. The tape was low in density—1600 bits per inch with only 4 tracks and 300 feet of

The tolerances required for the tape drives of the early 1970's were fine for then, but today's tape drives require much tighter tolerance. Today's tape cartridges must work with drives that have 90 more tracks and bit densities as high as 12,000 bits per inch on 600 feet of tape. That means capacity increases of 2,000 percent packed into the same cartridge.

the same cartridge.

The reasons that yesterday's cartridge technology simply won't work properly in today's high capacity drives is inherent in the cartridge design. The three culprits that make cartridge tolerances so important are fluctuating tape tension, redeposit nod-ules, and instantaneous speed variations (or ISV).

Tape Tension

Tape tension at the read-write head is important because the tape drive's electronics expect data to arrive at a constant rate. Consistent tape tension is a function of the cartridge tensioning mechanism. The new Cartrex cartridge tensioning design, based



The Cartrex cartridge provides predictable and stable tension. Compare it to the tension variation of the conventional cartridge design. The consistent Cartrex tension virtually eliminates data errors and data loss from heaft-traps separation and redeposit modales that can occur with fluctuating, low-to-high tension performance.



The new Cartrex V-inch tape cartridge is the first new tape cartridge design in almost a decade and a half. Tape drive monafacturers now have a new cartridge technidogy which allows them to advance today's and tomor-

on a mechanical differential between two stiff belts, provides very predictable results. The historic 3M design—used by 3M and DEI—uses an elastic belt coupled with drag friction at the rear pulley to create tension. The accompanying graph shows the significant improvement the Cartrex cartridge design offers over the conventional design.

Redeposit Nodules
Redeposit nodules are the insidious
flakes of tape media that break off from the
edges of the tape and get dragged to the
edge of the read-write head. If the tension
is low, or becomes low when the tape starts
or reverses, the flakes slide past the edge,

get smeared across the head, and reduce its ability to read data.

The free play in the two tape reels combined with the lange guides are the primary culprits in creating these redeposit nodules. As the tape entires the guide from the tape pack, the tape guide aligns the tape by balnating the terason at the edges of the tape. to fisher off causing redeposit nodules, but to fisher off causing redeposit nodules, but

ing" effect.

Cartrex eliminated the cause of the tape coining or scalloping with a barrel-shaped roller placed in front of the tape guide. The roller positions the tape and drops the edge tension to zero. By using this roller, the possibility of media flaking off and creating redeposit nodules is virtually eliminated.

Instantaneous Speed Variation (ISV) Instantaneous Speed Variation is exactly what it sounds like—small, instantaneous changes in tape speed as it crosses the tape head. At slow tape speeds and low bit densities—like the 1971 standard of 30 inches per second and 1,600 bits per inch—ISV wasn't as big a problem. At that time, the bits were crossing the head at 48,000 bits per bits were crossing the head at 48,000 bits per low.

Today, however, the story has changed. Ninety inches per second and 8,000 bits per inch mean that 720,000 bits cross the head every second. A 1,500% increase. As you CIRCLE 525 ON READER SERVICE CARD may have guessed, 1971 speed fluctuations in the 48,000 bits per second range made reading data difficult for tape drive electronics. But today, when the electronics have to guess whether or not the bit rate of 720,000 bits per second is accurate, the electronics have to guess whether or not the bit rate of 720,000 bits per second is accurate, the electronics have to guess the electronics have to guessian to the second second

tronics can become overwhelmed.

The Cartrex tensioning mechanism relieves the overload placed on the electronics
with respect to ISV. The longitudinally stiff
belts ensure tension at all times. The stiff
belt overpowers variations that exist with
the 3M elastic belt cartridges. The barrel
roller guides, in addition to reducing the
edge pressure to zero, tend to dampen out
any residual ISV effects.



High speed tape seldom exters tape guides parallel to the top and bottom, even with improvements to the tape red hald designs. The edge pressures which result create "scalloging" or "corning" on the tape. The effect is data look due to head-to-lape spectration, flating media that smears across the head, and "vedeposit nod ules" that create hard errors.

Never a Single Issue

Your tape drive seldom has the luxury of dealing with an isolated problem. It's usually a combination of 15V, redeposit nodules, and tension problems all together. Now you understand why Cartrex developed a modern cartridge alternative.

Where to get it

Not only has Cartrex improved on the industry's 15 year old technology, they have
done it for a competitive price.

Now you can have peace of mind when
you back up your hard disk on today's so-

phisticated tape drives.

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More Printer Support in Microsoft's New Chart

FIRST LOOK

BY DAVID HOFFMAN

With Microsoft Chart, Version 2.0, its popular business graphics program, Microsoft made an already good program even better. Importing data from such programs as 1-2-3 or dBASE III requires less effort, more data can be plotted in a greater array of colors, and changes made to data in an outside program are undated automatically

Microsoft added support for high-quality output devices, including film recorders, the VideoShow 150 display system, and the IBM Enhanced Graph-

ics Adapter. A separate conversion utility is no longer required to import data, which can come from Multiplan, 1-2-3 or Symphony, or dBASE II or III. as well as from any program supporting SYLK, DIF, columnar text, or comma-delimited formats. without the earlier version's requirement of a separate conver-

Composition of Factory Overhead



Microsoft Chart's output on an Apple Laserwriter, Chart 2.0 supports more high-quality output devices and simplifies importing data from 1-2-3 and dBASE.

linked to Chart, so that changes made in the other program will automatically show up in Chart. Higher-Resolution Output

The most important enhancement to Chart is its increased support for output devices, including Epson dot matrix printers in high-resolution mode, the HP Laserjet and Laserjet Plus (regular and high resolution), the Apple Laserwriter, any device that can communicate through the Postscript page-de-

sion. External files can now be scription language, typesetters, film recorders such as the Polaroid Palette and Matrix PCR with 2,000- by 2,000-line resolution on 35mm film, and the Video-Show 150 video display device from General Parametrics Chart can bandle 177 colors internally for devices capable of displaying them.

Each data series now handles 128 points rather than 64. There's an analyze math function, allowing a calculated series to be created from two existing series. Unavailable

values can be identified, creating blank spaces in a chart where they were formerly misrepresented as zeros.

Chart's added capabilities allow true reproduction-quality graphics and provide professional images at a very reasonable price.



Microsoft Chart. Version 2.0 Microsoft Corp. 10700 Northup Way Box 97200

Bellevue, WA 98009 (206) 828-8080 List Price: \$295; update, \$50 Site-licensing fees to be an-

Requires: DOS 2.0 or later; one double-sided disk drive: IBM Color/Graphics Adapter, Enhanced Graphics Adapter; or Hercules Graphics Card, Chart will run under TopView or Win-

In Short: The newest version of Chart supports more high-quality output devices and has in creased flexibility in using external data. No longer copy prosected.

Brother's Twinriter 5 Proves Two (Print) Heads Are Better than One

BY CHARLES PETZOLD You can stop banging your head against the platen trying to decide whether to buy a dot matrix or daisy wheel printer. Brother International Corp.'s Twinriter 5 combines both in one 15-inch wide-carriage machine. You can use the dot matrix for speed and graphics and the daisy wheel for less important documents, while eliminating the cabling or switching mess involved with two printers.

The nine-pin dot matrix head and 96-character dairy wheel mechanisms are attached side by side in one movable unit. The Twinriter 5 also supports two entire sets of control sequences, for Diablo or Epson emulation. (The manual, unfortunately, calls these only WP and DP modes.) Either emulation can be used with the daisy wheel or dot matrix print heads.

You can select any one or a combination of four modes by

using control sequences or the front-panel switches. The default power-on setting is selectable by DIP switches at the back of the printer. The Twinriter 5 supports the IBM character set for dot matrix printing screen-dump program for dot matrix Epson emulation. Aside from using the dot matrix for drafts and the daisy wheel for final copies and carbon forms, another obvious application for the Twinriter 5 is combining daisy wheel text and dot matrix graphs on a single page. Given the proper control sequences, the Twinriter 5 can even switch between the dot matrix and daisy wheel heads letter by letter in a single line.

speed test clocked the Twinriter 5 at 77 characters per second for the dot matrix and 34 cps for the daisy wheel. The default dot matrix print quality is below what you'd expect for a \$1,295 printer, but it's readable enough for drafts

The Twinriter 5 has only a friction feed standard, so you'll probably want to add either the optional single-bir. We inch cut sheet feeder (\$299) or the bidirectional tractor feed (\$149). A serial interface is also available.

The printer comes with 3 daisy wheels but a selection of over 180 more is available. A 172page manual with a good stepby-step beginner guide tops off this impressive package.



Brother International Corp. 8 Corporate Pl. Piscataway, NJ 08854 (201) 981-0300 List Price: \$1,295 Dimensions: 231/4"×8"×15" Actual Deaft CPS: Dot matrix 77 cps; daisy wheel printer, 34

In Short: At last, dot matrix and daisy wheel printer capabiltties in one machine

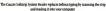
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Because strips are so easy to generate, most of your favorite magazines and books will soon be using them in addition to long lists of program code.

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popular magazines, computer books and text books.

send everything from correspondence to business information using our new technology.

Find out how much you can reveal by stripping. Just take this ad to your computer dealer for a demonstration of the Cauzin Softstrip System Reader

Or for more information and the name of the dealer nearest you, call Cauzin at 1-800-533-7323. In Connecticut, call 573-0150.



Cauzin Systems, Inc. 835 South Main St., Waterbury, CT 06706

Creating a simple, reliable and cost efficient way to distribute and retrieve information. Softstrip data strips, like those you see here, can contain anything that can be put on magnetic disks. Facts, Figures, Software programs,

then easily

entered into

Video games. Product demonstrations. Sheet music



patible with the IBM PC, Apple II and Macintosh.

A single strip can hold up to 5500 bytes of encoded data

It can stand up to wrinkles, scratches, ink marks, even coffee stains.

And it can be entered into your computer with a higher degree of reliability than most magnetic media.

SOME PC MAGAZINE TID-BITS

The two datastrips on the right contain five programs by Charles Petzald, a frequent contributor to PC, and are reprinted from a number of 1985 issues of PC Magazine.

DOIRs is a assembly language utility that displays all the usual directory information in we columns, that giving you must directory information per screen. It also autematically alphabetises the listing and pussess afterevery full screen. The program requires PC-DOS 2.0 as above. It will accept any drive, path, or filename parameter that would be accepted by DIR alone.

SWEEP by Charles Petzold, appeared in Volume 4 Number 23, November 1985, p. 265.

By itself SWEEP does nothing, but combine it with other commands and warth what happens.

Most commands and programs work only within a single subdirectory. Used with SWEEP,
commands oneente over multiple subdirectories on your hard disk.

WAITASEC appeared in Volume 4 Number 24, p. 215. Gooe are the flashing screen with important information strolling flater than the human eye can precive. Gooe are the multiple key strokes to make it stop. WAITASEC recalls text that has already scrolled off the top of your screen—up to 375 80-Golumn lines of it—and brings it back into view.

BAC.COM is more intelligent than COPY and more flexible than BACKUP, BAC COM utility speeds you through a chore you can't afford to neglect. This program appeared in Volume 4 Number 17, on page 197.

RED.COM moves files from one hard disk directory to another without all the COPYing and ERASEing bother. The program was highlighted in Valume 4 Number 4, on page 245.

You should refet to the particular issues mentioned for more information on the program and operating instruction before you read the strips into your computer.

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Softstric

COMMUNIOUÉS EDITED BY BILL HOWARD

What's Right with This Picture?

It was a slow news period just after New Year for Big Blue, so IBM's public relations flacks sent along this picture with the question, "What's this PC user doing wrong?"

In addition to poor posture and a protruding gut on the user that IBM didn't mention, IBM cites: rickety card table (vibration), proximity to radiator (heat) and open window (dust, heat, humidity, and sunlight), ashtray (tars and ash harm disk drive heads), drinks and food on top of the monitor, unsleeved disks, and a heavy clip attached to another disk that's about to be written on with a ballpoint rath-



Flight Stimulator

Every once in a while there comes a business and productivity tool that stops us in our tracks. This one is not it. But it's close: The Great International Paper Airplane Construction Kit, which can, with the aid of an IBM PC or compatible, elevate the practice of paper air-

plane flying from a meaningless

pastime to a true art. The program contains 13 airplane templates, files of hardware and decorations, and several predesigned starter planes. Once they are proficient, serious paper-plane pilots can cut and paste airplane designs in much the same way as they would use a word processor or spreadsheet. There is a database

of "neither rain nor sleet nor

It's also illegal. Government

regulations prohibit postal em-

gloom of night."

of wings, tails, and emblems. A color graphics card is required for operation, and the program works on the AT.

Once designed, the plane can be sent to the printer, folded, and flown. The Great International Paper Airplane Construction Kit comes from Simon and Schuster, 1230 Avenue of the Americas, New York, NY 10020. The program costs

No word on a frequent-flier discount.

Help Wanted

Heard anything unique or offbeat about the computer world? We'll pay contributors \$50 for every item published. Send your submissions to Communiqués, PC Magazine, One Park Avenue, New York, NY 10016: (212) 503-5293; MCI Mail 157-9301. Contributors to this page included Charles Bermant.

color CRT adapter, attachable

printer, and an expansion chassis that accepts normal PC cards

The Postman Wrings Efficiency

An enterprising Texas mail carrier, coping with the myriad details of his job, decided to let his PC do some of the work. He uses his PC at home to keep tabs on the people on his regular route-which names go with which houses, who is on vacation or out of town, and who is new on the block. If the postman takes a few days off, he makes a print-

out for his replacement. No doubt this results in better postal service, the kind of dedi-

cation harking back to the days

ployees, well meaning or not, from recording personal data about citizens A good excuse for poor postal service. puts, clock, and serial and par-

allel ports. Bondwell doesn't establish suggested list prices, but dealer cost is such that the unit should sell for around \$1,300

The Model 18 isn't quite built to the standards of a Compaq, but it looks like a competent performer.

Even more impressive was Sharp's \$1.795 PC-7000 19pound transportable. Its LCD screen with electroluminescent backlighting is absolutely the best LCD-based display yet seen. It is fast, smear-free, and easy to read-perhaps the first LCD screen that would be com-

fortable to work on all day The PC-7000 features an 8086 CPU running at either 7.37 MHz or the PC-standard 4.77 MHz. 320K RAM expandable to 704K internally, two double sided 514-Inch floppy drives, and serial and parallel ports. Options include a 300/1,200-bps modem card.

At CES: New Portables. Encyclopedia on a Disk

SHOW REPORT

BY GLENN HART LAS VEGAS-The lure of one of the world's great adult toy exhibitions was a compelling reason to return here-just five weeks after COMDEX-to attend the Consumer Electronics Show in mid-January.

While its primary focus was audio, video, watches, home computers, and even pornography, CES included a number of PC-related products.

For computer buffs, perhaps the most exciting event of the show was the actual introduction of CD-ROM technology into the retail market. CD ROM uses a variant of audio compact disk technology to store up to 600 megabytes of data on one optical disk less than 5 inches in diameter. Grolier Inc. has coded its 21-volume Academic American Encyclopedia onto one CD-ROM disk, occupying 110 megabytes. The disk, access software, and an elegant Phillips CD-ROM player can now be purchased as a package for \$1,495. The software, de-

veloped by Activenture (CP/M author Gary Kildall's new company), can search the encyclopedia in 5 to 12 seconds.

Low-Priced Portability Hong Kong producer Bondwell Inc. introduced what is probably the lowest-priced IBM PC-compatible portable. The Model 18 features 512K bytes of RAM two disk drives, a 9inch monochrome monitor. RGB and composite color outand an optional 10-megabyte hard disk. The PC-7000 runs on AC power only. The printer retails for \$399 and the modem card for \$349.

Cauzin Softstrip

The Cauzin Softstrip system was demonstrated in Kodak's booth. Softstrips are printed strips of information that can be reproduced in magazines. Several data densities are possible, up to 5.5K per strip. The \$200 optical-electronic reader is positioned over the strip and feeds the data to an attached computer. The system seemed to work perfectly, even reading short strips printed on the demonstrator business cards! The Cauzin system looks like an exciting software distribution method, although \$200 seems a bit steep to gain deep market penetration

for the electronic reader.

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For the name of the KnowledgeMan/2 dealer near you, call or write Micro Data Base Systems, Inc./ Marketing & Sales, P.O. Box 248, Lafayette, IN 47902. 317/463-2581, Telex 209147 ISE UR.





VM's Relay Gold Strikes Paydirt

FIRST LOOK

BY M. DAVID STONE Alone with Microsoft Access

and Microstuf's much-delayed Crosstolk Mork IV. Reloy Gold from VM Personal Computing gives new meaning to the term full-feotured communications progrom.

Some highlights:

. The most impressive feature is the concurrent capability. Relay Gold can transfer files in the background while the computer is running another program or is continuing keyboard communications. Also, if both

lay Gold, they can type at the same time: Anything typed at one computer goes into one window, while anything typed at the other computer goes into a second window

. It's easy to learn and easy to use. Relay Gold uses simple menus for entering commands, phone numbers, and communications parameters. Those who are familiar with communications should have no trouble getting started. Beginners will appreciate the on-screen tutorial, which takes less than an hour to go through and covers all the

essential features in the program. · The communications proscript language. As with Microsoft Access, the script language can handle anything from a simple automatic log-on sequence to a complicated unattended file transfer, and there's a learn mode in which the program will create a script by recording an on-line session.

Standard Fare

Of course, Relay Gold includes the expected automatic dialing and log-on, unattended operation, protocol file transfer, and everything else you can reasonably expect in a good tele-

communications program. By any measure, Relay Gold is a class act-a notch above otherwise-capable programs such as Crosstolk or VM's own Reloy, which has a similar screen feel but works differently. Try Relay Gold and you may agree that it's one of the few programs that's worth giving up

In fact, you may need to try two. While Relay Gold is not copy protected, it won't talk to another Relay Gold with the same serial number-a neat way to foil pirates without upsetting the honest user in the slightest.



Relay Gold, Version 1.0 VM Personal Computing 6 Germantown Rd. Danbury, CT 06810-9990 List Price: \$225 Requires: 128K RAM, one

disk drive. Haves-compatible modem or most other intelligent In Short: Among the best of the newest generation of sophisticated communications pro-

grams. Not copy protected. sides of a conversation have Regram includes a sophisticated PC-Tolk III for, even at \$225. Carbon Copy Allows Use Screen updates were impresproblem, so the expert can see it and demonstrate a solution.

Of PC from Remote Site

BY M. DAVID STONE Corbon Copy falls into a category of software that is new enough to qualify as a secret for most PC users. This category is the remote-operation program, a specialized form of a communications program that lets individuals use nearly any program on their PCs from a remote loca-

Carbon Copy works with many, but not all, popular programs. In the PC Magazine Labs tests, it worked with SuperColc 3. WordStar, Microsoft Word, Word Perfect, DisployWrite 2, WordStor 2000. and SideKick. But with XyWrite II Plus, ProKey 4.0, and Bellsoft Pop-Up programs, the system went down in flames. You should test your favorite program before assuming it works with Corbon Copy.

To run Corbon Copy, you need two computers, a copy of the program for each system, and two people. Load the program on the first computer and select the option from the menu to wait for a call. The second of the program on a remote computer, tells it to make the call, and enters a password to log on to the system. Once connected. Corbon Copy becomes invisible at the touch of a key.

Impressive Features

three noteworthy features:

Corbon Copy has at least program. A single keystroke

sively fast at 1200 band with Hayes modems and at 9600 baud with two computers connected directly. · Its memory-resident fea-

ture makes the program particularly useful as a technical support tool. Once you load Corbon Copy, it sits in memory waiting to be called on. If you run into a problem, you can phone an expert who has a copy of the program on his or her computer without leaving the

· The nontyping keys (such as the function keys and Ctrl. Alt, and Esc) on the remote

computer's keyboard work just like their counterparts on the local computer. This is in sharp contrast to Microstuf's similar REMOTE, which requires Ctrl key combinations to imitate the special keys

While not copy protected, Corbon Copy checks the serial number of the Carbon Copy running at the other end of the line and continues only if the two are different.



Curbon Copy, a men wy-resident program, offers remove operation of the land PC. hts easy-to-use setup menu aids speedy communications.

Carbon Copy, Version 2.14

Meridian Technology 1101 Dove St., #120 Newport Bench, CA 92660 List Price: \$195

Requires: 20K RAM, DOS 2.0 or later, Hayes-compatible mo-In Short: A sophisticated mem-

ory-resident program allowing remote PC operation and cocomputing. Not copy protected.



PreCursor™ is an amazingly compact and sophisticated indexing system for your hard disk. It runs just ahead of your other applications and makes some very user-friendly arrangements. And at a very businesslike price.

Without PreCursor in, it takes a whole manual of commands to find and execute programs from your hard disk. In a business setting, where novice users must access your system, this is aggravating and expensive.

Tailoring PreCursor[™] to your system is an easy operation. On-line help is available at the touch of a function key. A triple level of password protection is built right in. You don't need to know paths or subdirectories or other complicated syntax. You can even change the color of PreCursor.

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After PreCursor" is setup on your hard disk, it greets you each time the machine is turned on with a list of available programs. You can make simple index choices of even the most complex DOS commands. And set up your printer with the speed and ease of an old pro.

If you're a sophisticated user, you'll love the convenience of full interaction with batch files, passable parameters and user prompts. Home users will appreciate the sure ease of operation.

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CIRCLE 198 ON READER SERVICE CARD

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HAVE A NICE INQUISITION, DEAR. When Infoworld's contributing edi-

tor, Bernie Zilberoold and the InfoWorld Review Board raid they reviewed our ATplus20" hard disk drive, we figured that they gave it the routine technical and performance diagnostics.

We didn't expect destructive testing. They went after our levendary

resistance to head-crashes with a vengeance.

HOW TO HENCH.

Mr. 2 and his henchpersons began by subjecting the drive to 3,500 stops and starts.

Having survived this, our ATphis20" drive then had to face increasingly severe physical torture while performing a seemingly relentless series of track seeking operations.

THINGS THAT GO BUMP IN THE DAY.

Further henching resulted in their bumping the table that the ATplus 20"

was running on. Then they dropped one side of the table from a height of six inches.

Next, the entire table was lifted one foot above the floor and dropped.

the course of th

Then, they threw the book at us. Actually, they dropped a rather heavy book directly on top of the drive GUESS WHAT?

You're absolutely right. CORE's ATplus20" hard disk drive not only survived, but continued to perform as specified. Each of the rather unnerving tests

was repeated a number of times on the same drive, just to be extra sure. Or mean.

THE LAWYER'S 24. The tests were so nasty that they

had to publish the following warning: "We caution you not to perform any of these tests on your own equipment." We have to agree.

These tests were done to determine the limits of the drive, and were intentionally extreme beyond the normal use environment.

SEAL OF APPROVAL

We're delighted that InfoWorld tested, evaluated and validated, exactly what we have been saying all along. Now you can build the enhanced PC-AT that IBM didn't.



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We're the world's largest supplier of high-performance PC-AT compatible hard disk drives. Now, respected magazines such as InfoNorld and PC Magazine have told

you how we got there

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WE WANT **STANDARDS**



Most mature industries have standards committees. When will the personal computer industry grow up-not only in hardware, but in software?

o two software products work the same way. No two printers have the same control and escape sequences. No two manufacturers can agree on anything. As the cop said in Cool Hand Luke. "What we got here is a failure to communicate."

How is a standard set in the PC marketplace? Computer hardware is the easy part: IBM comes out with a product, everyone else scoffs at it, then they kill themselves and one another trying to get their imitation into production. A new machine that achieves instant

market acceptance is a de facto standard. The IBM PC is the all-time shining example of such a machine. Pundits ripped the PC to shreds. Businessmen ignored reality, bought the machine by the carload, and the rest is history. IBM took as big a risk as any other manufacturer at the time and, if the truth be told, had no idea what it was getting into.

Color television, on the other hand, is a good example of a legislated/negotiated standard. Everyone (well, nearly everyone) agreed in advance how the stations would transmit and how the sets would receive. Implementation was left up to the individual manufacturer, but no one had to reinvent the wheel. All the risks were taken before the first commercial set was manufactured, not after. It's endlessly fascinating that the Japa-

nese got color TV so right and IBM-compatible personal computing so wrong. Perhaps it's a comment on Japanese culture that they were able to recognize and capitalize on a legislated standard and utterly

unable to recognize the IBM standard. They kept trying to "improve" the standard-and couldn't sell a thing.

I'm also astounded that it took them three distinct waves of machines before they gave up. Maybe pride was a factor. The Japanese have been trying to shed the "imitator" label and the implication of shoddy goods since the 1950s. Maybe they were honestly trying to advance the state of the art, but, unfortunately, the state of the art has nothing to do with the de facto standard and concomitant market acceptance.

SOFTWARE-INTO THE FIRE Hardware is the good news. Build it like IBM. market it like crazy, and maybe you'll get a piece of the pie. But software is a completely different story. What can you say about a market in which the leading word processor doesn't have 10 percent market share? Calling it fragmented is like saving that Mount Saint Helens made a mess



The few standards that exist are largely derived from hardware, such as the keyboard. The availability of predefined Home, End, and cursor control keys may have stifled the "creativity" of some programmers but is a blessing for the rest of us. Beyond the predefined keys, dominant software products such as Lotus's 1-2-3 set other standards. Using F1 for help, for instance, is 1-2-3-inspired and has been used by dozens of other packages.

1-2-3's moving-bar menu is another clear example of a de facto standard that helps the entire industry. Microsoft first developed the basic command menu design in MultiPlan, but less successfully. The interface was marred by its use of the Tab key and a few other quirks that time and customers have not blessed with accolades. Lotus's refinement has been so successful that users with even just a little experience know that they can either type the first character of a command or move the highlighted bar with the cursor controls. Any package that uses this feature is virtually guaranteed to be better accepted by users and be easier to learn.

However, the moving-bar menu standard is not the only accepted interface solution. The Macintosh-like pull-down menus like those in Ashton-Tate's Framework are gaining in popularity. Framework also proves that although pull-down menus were originally meant to work with a mouse, they can be usable without one. If you do want a mouse, the Microsoft Windows design is a standard with lots of potential.

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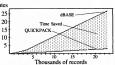
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■ FROM THE EDITOR'S SCREEN

Memory Specification is an example of a standard that isn't in everyone's best interset. It accomplishes a specific task for a special-interest group: users of very large specialstess. Microsoft was forced to buy into the spec in order to maintain control of a function that the operating system should handle, not an application program. In this case, the user needs eclipsed the capabilities of the available handware and operating systems offstime.

The LIM spec has subsequently been bastardized to run RAMdisks and other applications that capitalize on its ability to use memory beyond the 640K limit. But it's still not a good spec. In fact, no scheme that uses 16K bank-switched windows and is managed in software rather than hardware will satisfy lone-term needs.

AST came up with an alternative, more feetible supernet of the standard that uses 64K windows but is still not a long-term soution. Lotus and Intel unfortunately had too many proprietary interests at that point to buy in. Ever since, AST and Intel sales reps have been lying about one another's standards. I say life is too short for these handles, folks, so I d like to set the record straight. AST ExEMS is a true superset. Software that works under the LIMI spec-crops would have been better off with EEMS sham with LIM, but, then, neither will matter worth a dame in 2 veans.

DEMAND THE BEST It's time for a standard graphical interface for the IBM PC family. The progress made in speed, graphics boards, and monitors says so. So do users who need a break from the endlessly reinvented interfaces sported by new applications. But it won't come automatically. You've got to ask for it. You know where I stand: Microsoft Windows is a viable answer to the lack of standards. In early February, Microsoft held a 2-day seminar for prospective Windows software developers. Part information exchange, part industry gathering (with a little Bible-thumping for good measure), the meeting laid down the challenge for the software industry: The standard works. Applications will be smaller, easier to use, easy to integrate with other Windows-compatible applications, and more marketable. A shining example is all of Microsoft's consumer software products, which it is currently rewriting for Windows.

Microsoft has the vision and the position to make Windows work. It is also inviting manufacturers to connecte with its

virtual monopoly on Windows application software. This invitation isn't altruism; it's a smart investment— the kind of investment that will catapult us to the next level of personal computing standards.

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KEEPING DISK SPACE CLEAN WITH CHKDSK



Lost clusters—the no-man's land of disk space—neither can accept new data nor belong to a particular file. Helping you decide what to do with them is part of CHKDSK's job.

In my last column, I talked about disk orphans, the "lost" clusters that the CHKDSK program occasionally re-

post.

The most common way those fost clear

record both when programs stars to
create a file, then drops it is an incomplete
star. Files are created in three stages.
They are "opened" (which, in effect, dile
files them; they are written to, filling
them with data (which sets their content),
and they are closed (which establishes
them as complete files on the disk.) If the
first two steps lades place without the find,
absorbed data may be left on the disk in
CHKOSK to repair meants.

Programs shouldn't abandon unfinished files, but they sometimes do—Version I. Oof the IBM/Microsoft Pascal compiler did this with appalling regularity. This sort of thing happens less nowadays, partly because the overall quality of programs has improved and partly because DOS now does a better job of protecting your disks.

Of course, programs abandon "open" files, leaving lost clusters, in all sorts of ways. If a program crashes or if you lose power in the middle of things, your disks will also be scrambled.

But the most important question is not "How does it happen?" but "What should you do about the lost clusters?"

CHECK FOR DISK PROBLEMS First, you should check for disk problems on a regular basis. If you work on a hard disk, it's relatively simple to add CHKDSK to your start-up AUTOEXEC BAT file. By doing this, you'll know at a glance if some-thing has gone wrong with your disk: if all is well, as it usually is, a quick check every day at what CHKDSK reports is still worthwhile simply to find out how much space has been used up on your disk and how much remains for new files.

Checking your disks on a floppy-based PC isn't as convenient as it is with a hard disk (but, then again, everything is less convenient with floppies). Basically, you need to figure out how to best fit CHKDSK into your routine of working with, and switching, your floppies. You don't want to CHKDSK things to death, but to protect your disks, you should CHKDSK each one regularly, essecially your data disks.

It's completely harmicss to test your disks freely, because, with the exception of some prehistoric versions of DOS, CHKDSK doesn't change anything on your disk without your permission.



GET RID OF LOST CLUSTERS If CHRDSK unovers any lost clusters, you should get rid of them. No harm is done to your disk by orphan clusters, so getting rid of them is no four-alarm emergency. But they do waste space on your disk. (The same can be said about files you leave around that aren't actually needed.) In addition, you will want to know if the orphan clusters are being created on a regular basis—which you won't find out if you don't

erase them-because that could indicate a

bug in your system. You need to know two things to get CHKDSK to clean up your disks. The first, an easy one for novices to overfook, is the "fix", switch (F) that you must enter along with the CHKDSK command. If the fix switch hin't set, CHKDSK will make no changes to your disk—I will just report what it would do if you gave it permission to fix the disk.

If you turn on the ff fix switch, you give CHKOSK permission to clean up the or Phares. Recall that lost clusters are in a noman 's-and retween the disk'. Fix expect the disk'. Fix expects the cluster of the long to any particular file, either. Thus they are in disk inhoc, caught between the free space and the file space. When you turn on the f's switch, CHKOSK will peak the cluster of the cluster of the cluster of the cluster of will cluster make them into files or create free space.

If CHKDSK finds any lost clusters, it will pause to ask you what you want to do with them. Under most circumstances,



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■ THE NORTON CHRONICLES

you should free them up—discarding whatever data (most likely garbage) might be stored in the lost clusters.

oe stored in the lost clusters.

Now, you may recoil from that advice in horror—a natural reaction the first few innew your fe faced with the choice that CHKOSK presents you with. After all, if you have any understanding of how lost you have any understanding of how lost and you have any understanding of how lost aboutdoned data in them that might be important. Certainly the data is in a fragile state. And it might seem crazy to toss it away cavalierly.

away cavalierly.

But the truth is that the data in those lost clusters was probably intended to be discarded, and even if it's useful data, chances are that it's not usable data. That's because whatever is stored in those lost clusters is probably just a fragment of

 The most common way lost clusters come about is when a program starts to create a file,

then drops it in an incomplete state.

whatever file it might have become. And, with a few happy exceptions, most files can't be used in an incomplete state. Your files, including both program files and data files, are generally an all-or-nothing proposition. If any of the data is missing, usually none of it is usable. That's why it's usually best to tell CHKDSK to throw away data in lost clusters and free up the space they occupied.

CONVERTING CLUSTERS INTO FILES If you're nervous about such a seemingly dangerous course of action as throwing this data away, you can tell CHKDSK to convert these abandoned clusters into files

CHKDSK turns the lost clusters into files with names such as FILE0000.CHK and FILE0001.CHK. To do this, CHKDSK creates artificial directory entries, which means that none of the information that usually identifies your data will be there. The name will be artificial, like the examples here, the date and time stamp will be missing, and even the file

size will be only approximate. So, if you want to know anything about the files that CHKDSK makes from the lost clusters, you must take a look at the data that's inside

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SNOOPING TOOLS To look at the data, you need a snooping tool, such as DEBUG or my Norton Utilities. But if you don't have or don't want to use a real snooping tool, you can simply copy the data to the display screen. You can use the TYPE command, but it is even better to use the COPY command, like this: COPY YILE "CHIK CON: /B. That command

 You will want to know if orphan clusters are being created on a regular basis because that could indicate a bug in your system.

will round up all the artificial files that CHKDSK may have created and show you their contents; the /B switch makes sure that you see all of the data (but be prepared to pay a price for this operation: You'll have to listen to your computer's speaker beep like crazy).

If you see any vital data, you can rename the file with an appropriate name and work with it however you want. If there isn't any important data, you can delete the files with the command DEL VFILE*. CHK, and the lost clusters that were converted into files will switch back to the free space on your disk.

If lost clusters occasionally show up on your disks and you take the lengthier option of capturing the data, inspecting it, and then discarding it, chances are you'll quickly come to the same conclusion as I did: that you might as well have thrown it away in the first place by telling CHKDSK not to convert the lost clusters into files.

I should add one word of caution to all this: Don't make the /F fix switch a routine part of your CHKDSK commands. That's because you shouldn't have CHKDSK try to fix up your disks until you've had a chance to see if what it says is wrong. Lost clusters aren't the only thing that can go wrong with your disk latthough they are the most common), and fixing them isn't the only way that CHKDSK can modify

your disk.

In the next episode of this disk saga, I'll look at some of the other things CHKDSK

might do—unless some exciting and latebreaking news that I'm expecting interrupts our disk discussion. But, in any case, I'll soon be back exploring the mysteries of worky disks.



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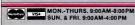
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Building in Those essential "Options"



Many features now sold separately as options on add-in cards will, within the next couple of generations of PCs, become standard functions on the motherboard.

That's going to be the idea behind a lot of the evolutionary changes you'll see over the next few generations of PCs. Rather than having to add-in

ations of PCs. Rather than having to add-in to your PC, after purchase, everything under the sun—from clock/calendar cards to video cards to extra serial port cards you'll find most of that stuff built in.

For the manufacturer, it's far cheaper to simply baild in a feature on the assembly intended in the design, make, and self that same features expensively. For the user, a same features expensively. For the user, a the most important features—other than a bare-hones Erector Kis-style chassis that has to be built up to do even the most common work—sia no ovivous gain, to say nothing of the increased reliability of common work—sia no ovivous gain, to say nothing of the increased reliability of common work—sia machine. The clear advantage, of comments is that you avoid the "Will it work with mine?" compatibility questions.

THE AT SETS THE PACE IBM understood the advantages and economies of sticking features on the motherboard when it was designing the PC AT. The AT has no aftermarket for four-function, add-in boards like that for the original PC, which required expensive, space-consuming add-in-cards for RAM, a clock/claelndard would those infurtiaring date and time prompts, a serial port or two, and another parallel port.

The AT appeared furnished with a built-in clock/calendar, built-in parallel and serial ports, and a weird-looking combination of piggybacked memory chips to

provide 512K RAM on the motherboard. The cost to IBM of building in those features was maybe a tenth the cost to you of adding them later with extra boards. Since IBM could fairly assume that the great majority of AT users would need and want these features, it was a good bargain all around.

APPLE LEARNS ITS LESSON But those assumptions about what people do and don't need can be risky, especially when your confidence that you know what they need forecloses their options. Apple learned this lesson well with its Ifc.

Apple was confident it knew just exactby what Apple owners wanted, and in the Ili built a no-slot, all-in-the-box machine. Apple thought the IIc would quickly kill off the expensive-to-build Ile and allow the company to move profitably toward a single II-style machine. Ha! Apple owners flocked to the expandable Ile, increasing



inventories and costs for both Apple and its dealers. The IIc became a kind of Yuppie totem, an elegant, trendy objet d'art for people who didn't really want a home computer but didn't want to seem out of touch.

Apple's costly lesson was well noted throughout the personal computer industry; so you can expect IBM and friends to tread softly. While you'll see a lot more built into the box in the next round of IBM desktop-style personal computers, you're milikely to see use of those built-ins made mandatory and very unlikely to see a no-stot box with IBM's name on!

What are the likely candidates for additions to the features already found on the Fe AT's motherboard? At the top of the PE AT's motherboard? At the top of the list is ivide of tirre circuitys, almost certainly in the form of a chip set offering the BIM Enhanced Graphics Adapter (EGA) color/graphics standard. Adding in a video card is fundamentally absurd, and now that BIM has the EGA—a standard it really wants to push—the advantages of putting those circuits on the motherboard are overwhelming.

Remember that the EGA spc (which, it is slow start novibitsatisfine, is rapidly becoming the IBM video display standard) is really a whole set of standards—which is inturn the main reason that it's so tough from programmers to handle. EGA includes the old IBM Color/Graphics Adapter low—and medium—resolution color and (stort of) high-resolution monochrome standards, the original IBM 720 by 30b high-resolution (green phosphor monitor/alphanumerics only) monochrome standard, and (de-ics only) monochrome standard, and (de-i

PC PERSPECTIVES

pending on the amount of video memory that is installed for the EGA's use) a variety of color palette sizes in the EGA's normal 640 by 350 mode.

So, at least from IBM's perspective, it's if you do it right and on a large enough

an ideal built-in. Cheap, too: Even the plethora of \$400-\$500 EGA knock-offs available now don't begin to demonstrate how cheap the EGA can be to implement, scale. Designers working on the next cycle of PCs tell me the EGA could be built into an AT-style board for less than \$80 per

machine-maybe much less. But IBM knows how unhappy you'd be if you couldn't use all your esoteric video boards that are incompatible with everything else from Tecmar's Graphics Master to the Plantronics color card. You can count on being able to enable or disable the built-in EGA circuitry by moving a few jumpers. Cynics might say IBM's concern over antitrust suits by third-party board

 Designers of the next cycle of PCs tell me the AT-style board for less than \$80 per machine.

FGA could be built into an

makers frozen out of a new PC would play a part in that decision as well. So much for display circuitry. What

else? A full complement of serial and parallel ports is a fair bet. Here again, it's just so cheap to do it right, building them in at the factory. How cheap? Here's a hint: the 36pin (parallel) and 9-pin or 25-pin (serial) connectors are a large part of the cost. Wouldn't it be nice to find, say, two parallel and two serial ports on the machine? (1 know: It would be even better to find four

or five serial ports, transcending the ridiculous DOS limit on directly addressable ports to COM1; and COM2;. But that an-

swer's coming soon, too, in another form.) AN IBM TOKEN-RING NETWORK IN-TERFACE How about an IBM tokenring network interface on the board? It

makes sense and would be a splendid demonstration of IBM's commitment to networking. Once again, this built-in would be relatively cheap, too, thanks to the Texas Instruments chip set that drives the PC-network interface. But it's unlikely, for just that reason: Big Blue plans to sell lots of add-in cards to connect PCs to



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the network. Why throw away those sales?

How about a built-in modem? Rockwell's Hayes command-compatible 1,200 bps modem chip set makes this one relatively cheap and easy, too. But the spectre of litigation from unhappy third-party modem vendors hangs over a built-in modern. You can also make a fair case that with modem speeds ratcheting up through 2,400 bps to 10,000 bps and beyond, a 1,200 bps built-in would soon become a nonfeature

Probably the single most intriguing prospect is building in user-accessible software on read-only memory (ROM) chips. DOS on a chip, or maybe just a graphicsbased TopView on a chip, is certainly possible, and in sufficient quantities, cheap enough to be practical. The cost of designing, burning, and installing software on ROMs has so far limited its use to boot-up diagnostics and other low-level system functions. But there's nothing final about those decisions, nor the cost/benefit ratios upon which they're based.

THE PROBLEM OF UPDATES Updates are a serious problem with built-in silicon-based software: Even if you wouldn't have any trouble prying out the old ROM chip set and sticking the new ones in, lots of PC users would.

So tossing DOS into a new PC on a ROM chip is unlikely, feasible though it may be economically and technically. A "chipped" windowing system isn't quite so far-fetched, but don't look for it on the next generation of machines.

Application programs on ROM chips are surely coming too, but again, not on the next issue of desktop IBM PCs. Just look at the support Tandy's gotten from third-party vendors for its empty add-in ROM-chip socket on the Model 100 laptop. Silicon software makes perfect sense, and someday it'll be the standard. But not until the industry finds a better system than DIP sockets, Molex chip-carriers, and the rest of today's fragile, static-sensitive means of swapping chips.

What is needed is something like an icecube tray: a whole row of cubelike sockets into which you just push a little lump of silicon-one way only, please. No broken pins, no putting the chip in backwards, no frying its brains with static.

It's important in this what's-coming | business to be duly cautious and draw the line between speculation and certainty; what I foresee going onto the motherboards of the next IBM PCs (dare I call a half-dozen, to go.

them PC2s?) falls in that first category. But there is also, ahem, such a thing as informed speculation.

Just put it on the board, please. I'll take



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A SENSE OF RESPONSIBILITY



Computer Professionals for Social Responsibility is concerned about the use and abuse of computers in the military, particularly in "fail-safe" nuclear weapons.

omputer Professionals for Social Responsibility (CPSR) occupies two rooms on the ground floor of a small office building in downtown Palo Alto, California. There's an unoccupied movie theater next door, an unoccupied store next to that, and a Buick dealer down the street-it's exactly the kind of low-rent neighborhood where nonprofit organizations like CPSR are usually found. (But the foundations that support them are just as usually located in the glass-and-steel skyscrapers of New York, San Francisco, and other big cities.) CPSR has a typewriter, an answering machine, a photocopier, a pair of Apple computers, and a staff of two.

At the urging of an engineer friend of mine of decidedly countercultural bent, I visited CPSR recently. Gary Chapman, CPSR's new executive director, was working with one of the Apples, finishing an article for the CPSR newsletter. There was an antiwar poster on the wall (a quotation from Einstein that read, in part, "the unleashed power of the atom has changed everything but our way of thinking") and a tall bookcase next to the door, containing short stacks of photocopied articles on CPSR and on the Pentagon's Star Wars System. Chapman put his computer on hold and rose to greet me. He's a casual, affable young man who joined CPSR in June from Stanford University, where he is a doctoral candidate in the political science department.

We repaired to a nearby deli and discussed CPSR over lunch. Lasked him how CPSR was born.

"It started about 3 years ago," he began, "as an electronic mail network on a computer system that was run by DOD [the Department of Defense]. The network was set up by some people at the Xerox research center here in Palo Alto, but I can't tell you the name of the system-it's pretty well known, and I don't want to get anyone in trouble. 'Initially, the network was just a list of

people interested in the antiwar movement. They would exchange comments about the movement and their defense work; most of them were programmers and computer scientests working on military projects. Anyway, some of the people in the Silicon Valley area who were on the network started meeting in each other's homes. CPSR grew out of that. Terry Winograd, the AI expert at Stanford, was one of the founders, and he's on the board of directors. The first public meeting was held at Stanford in June 1983.



"I'm sure you've heard of Physicians for Social Responsibility [PSR]," Chapman continued, "Well, our group was inspired by PSR, which tries to alert the public to the medical consequences of nuclear war. Our primary focus is quite different. What we want to do is inform the public about the role of computer technology in nuclear weapons systems. Of course, we're also interested in the abuse of computer technology in general, but the use of computers in nuclear weapons systems is our main focus." (See "Can Computers Be Fail-Safe?" PC Magazine, Volume 5 Number 1).

CPSR, he told me, is engaged in many different kinds of activities. Two members, Greg Nelson and Dave Redell, recently wrote a highly critical, detailed analysis of the computing requirements of the Star Wars project; CPSR distributed their paper to computer scientists all over the country. Other members produced a slide show about the use of computers in nuclear weapons systems; the show was designed for the general public. And the group holds regular talks about abuses of computer technology by the military. It is also working on three long-term projects.

The first is to organize a conference in Washington, D.C., on the danger of accidental nuclear war, Chapman said. "We haven't gotten very far on this yet; we hope to hold the conference sometime next year. The second is a study of the social responsibility of people working on DOD contracts-we're trying to raise money to give honoraria to four philosophers to talk about the ethical issues of working on mili-

■ COMPUTERS IN SOCIETY

tary projects. And the third is to publish a curriculum on the social and ethical aspects of computers for college teachers, to encourage computer science departments to give courses on the subject.

"We're not concerned so much about the fundamental matter of whether or not programmers, engineers, and computer scientists should work for DOD. We're not naive: we're not barroom philosophers. We know that most of the money in certain areas of computer research, particularly AI, comes from DOD. We can't say and we don't want to say that these projects are unethical and that the people working on them should quit. Some aspects of defense work, such as the development of defensive weapons systems, are really quite ethical.

"What we want to do is to let people know that there are certain places where computers shouldn't be used, not for idealobjective ones."

istic, pie-in-the-sky reasons but for very

 In launch on warning. the decision to launch

a nuclear strike against the Soviet Union would be made at the first sign of a

Soviet attack. Chapman gave me two examples: the

launch-on-warning policy and the autonomous tank. In launch on warning, the decision to launch a nuclear strike against the Soviet Union would be made at the first sign of a Soviet attack. At the first sign. U.S. computers would evaluate the attack and decide whether it was a false alarm or real. Then, if the generals and the politicians concurred, a counterattack would be ordered. But they would have so little time to evaluate the situation that the decision to retaliate would have to be based on what the computers told them. "We think it's a terrible idea." Chapman said, "a disastrous idea, to put that much trust in computers, but the arms race is pushing the country in that direction."

The second example is the autonomous tank, now under development. "Basically," said Chapman, "it's a tank guided by intelligent computers. An automatic killing machine, without human onerators. You couldn't pick an environment

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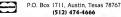


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■ COMPUTERS IN SOCIETY

more unsuitable to AI than the battlefield.
AI systems are very brittle. They tend to fail at the outer limits of the technology, when they meet the unexpected. What happens if an autonomous tank goes hay-

wire and starts shooting at American units? What happens if it murders innocent civilians? An autonomous tank is not a Lieutenant Calley; you can't put it on trial and throw it in iail. It doesn't feel rezert. "We don't think that life-and-death decisions ought to be made by computers. And we're heading toward a situation where the most important decision—the finger on the nuclear trigger—will be given to computers. There's just too much room for accident, for error. Anyone who's ever worked with a computer knows how fickle they can be. There's no such hing as a foolproof computer system.

 "We're heading toward a situation where the most important decision the finger on the nuclear trigger—will be given to computers," said Chapman.

"We also want to publicize the unethical use of computers in nonmilitary settings," Chapman continued. "For example, word processing shops sometimes program their computers to monitor the keystroke speed of their typists. That puts an unfair amount of pressure on the typists. It's possible to force typists to pick up their speed by establishing keystroke quotas.

"Then there's the loan of computer databases to government agencies. The IRS gave taxpayer lists to the Selective Service Administration, even though these lists are supposed to be confidential. And believe it or not. Baskin-Robbins, the chain of ice cream stores, gave a database of birthdays and names to the Selective Service. (Apparently, when it's your birthday and you want a free ice cream cone or sundae from Baskin-Robbins, you fill out a card with your name and address on it.) We just want to point out that computers are being used for these kinds of things. In some cases, computers are very helpful; in others. they're very pemicious."

I asked Chapman how he came to be involved in CPSR.



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■ COMPUTERS IN SOCIETY

"I've always been interested in electronics, computers, and military affairs. My father was an engineer for Hughes Aircraft in L.A. He worked on infrared sensors for the TOW antiaircraft missile and

for other projects. He's retired now.

"After high school, I enlisted in the Army. I was a Green Beret in Vietnam, in the Central Highlands, a sergeant.... I was in the Army for 4 years, mostly as a Green Beret. I spent a lot of time working with high-tech equipment.

"After the Army, I went to college— Occidental in L.A.—where I studied political science. Then I went to graduate school at Stanford, where I'm an A.B.D.—all but dissertation. I was doing research on the use of artificial intelligence systems by the military.

"Ever since the Army, I've been an activist. I've worked as a volunteer for various organizations: the United Nations Association, the California Seminar on Arms Control and Foreign Policy, the Women's

CPSR plans to

publicize the unethical use of computers in nonmilitary settings.

International League for Peace and Freedom, the Citizen's Party. Terry Winograd told me about CPSR—he thought it had some information that could be useful for my research—and I ended up applying for the director's iob."

I walked Chapman back to his office. A week later, I ran into him on University Avenue, Palo Alto's main drag, a few blocks from his office. He was beaming.

"Did you hear the good news?"
"What news?" I asked.

"International Physicians for the Prevention of Nuclear War won the Nobel Peace Prize!"

CPSR has about 800 members in 12 chapters throughout the United States (Berledey, Boaton, Los Angeles; Modison, Wisconsin; New York; Palo Allo; Pittsuph; Portland, Oregon; San Joses, Santa Craz, California; and Scentle, It also halto alou 150 members in five foreign did actes (Australia, Canada, Italy, New Zeanda, and Scodalod). The annual dues are \$30 a year for programmers, engineers, and abor professionals; \$50 for students.

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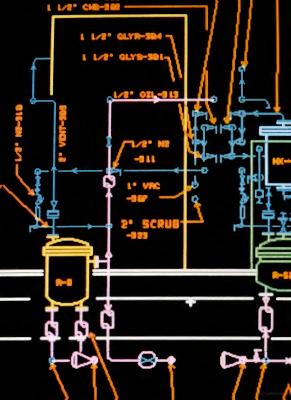
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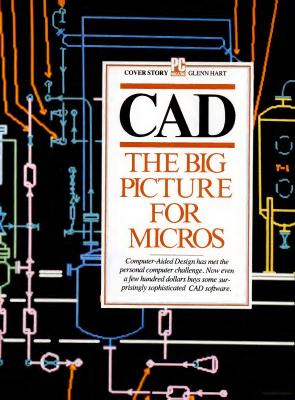
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PC4







AD, which stands for Computer Aided Design, has been around a lot longer than personal computers. But unlike some technologies (project management, expert systems) ported down from traditional mainframe and minicomputer environments, CAD products met with immediate interest and strong demand from users. They were among the single applications, like word processing and spreadsheets, that for some users justified their purchases of personal computers.

So, CAD and personal computers have flourished together. The last couple of years, a period of retrenching for some parts of the PC industry, have been a period of innovation and expansion for computer-aided design and the allied technologies of computer-aided drafting and manufacturing (CADD/CAM). Extensive research, new product introductions, intense marketing efforts, and skyrocketing sales have even drawn the attention of the mainstream press, which has pegged CADD/CAM as the coming salvation of American industrial enterprise.

That assessment seems overblown, mainly because American industry does not have a monopoly on CADD/CAM. Besides, the technology needs several major breakthroughs before it can legitimately claim to be a panacea.

Still, CAD is exciting. It's doing more for more users than ever before. The personal computer has set in motion forces that have brought surprisingly sophisticated low-end CAD software within the reach of anyone who can part with a hundred dollars (see the sidebar, "Generic CADD" in the review section, "Complex CAD Software for the PC," immediately following this introduction). It has changed the way several professions do business. It has increased efficiency as well as capability.

A CAD METAPHOR When PC Magazine last published cover story reviews of CAD products in July 1984, we explained that "CAD programs are to images what word processors are to words: You use them to create, edit, and make hard copy. but the medium is pictures." This hasn't changed. A CAD system does not design anything, any more than a word processor

does creative writing-the computer is simply a tool.

CAD can be thought of as "image processing." The process of creating an image with a CAD system is akin to that of creating a document. Information is entered into the computer and edited: then

 A CAD system doesn't design anything, any more than a word processor does creative writing-the computer is simply a tool.

hard copy is produced. The software can make these processes faster and easier. The computer also stores the work for future reuse. Someone once said that at its core, word processing is merely the saving of typed keystrokes; in the same way, CAD can be said to be the storage of graphics instructions.

Maryann Zadfar, marketing director of

Autodesk, the company that manufactures the industry leader AutoCAD, calls CAD

"a horizontal vertical." CAD is generally perceived as a specialized vertical market category, but the range of potential users covers so many different disciplines that CAD seems horizontal. It has more in common with a general (horizontal) database program than with, say, a specialized (vertical) inventory tracking system or dental-office accounting package.

This wide range of potential users has implications for the way CAD programs are designed. The needs of mechanical engineers, architects, circuit board designers, civil engineers and surveyors, interior planners, and the other CAD users are so diverse that programs attempting to serve these disparate audiences tend to be both flexible and complex. Many companies that do not offer their own CAD programs contribute to the diversity of related products by offering a tremendous selection of add-on programs that increase functionality. In addition, personal computer CAD programs geared to the needs of a single specialty are beginning to appear. For the most part, however, general-purpose CAD programs have met with wide acceptance. How wide? International Data Corp. of Framingham, Massachusetts, es-





EDITOR'S CHOICE

When a program is dominant in its category, as, say, dBASE is in database management, there is a natural expectation that it is also the best program of its type. Of course, factors like timing, marketing expertise, funding, and luck play some part, but still the assumption is the quality of the leading program must be excellent. And in fact it often is.

AUTOCAD The first Editor's Choice. Autodesk's AutoCAD, enjoys a huge market share, and all of the above factors have contributed. AutoCAD is truly a first-rate general-purpose personal computer CAD. It is flexible and comprehensive, accurate and powerful. Many of its features are unmatched partly due to many rough edges in inby other micro CADs. Of course, like nearly every product, it has blemishes and areas that need improvement, but in general AutoCAD is solid and dependable program.

But perhaps the most important reason to select AutoCAD as the software package of choice is its very dominance. Because of the large user base enjoyed by AutoCAD, third-party software developers have created a tremendous selection of ancillary programs that add new fluctions customize AutoCAD to specific disciplines, provide predrawn symbol libraries, and address AutoCAD's isolated weak spots. Over 150 programs are now available that work with Auto-CAD, not to mention books, training tapes, and other tools that help you learn and master this complex program. By contrast, none of the other CADs evaluated offer more than a handful of outside programs, and several aren't supported by any third-par-

ty vendors. In spite of AutoCAD's dominance and excellence, the other general-purpose CADs reviewed in this issue each had something to offer, although, with the exception of CADKEY, none distinouished itself as an Editor's Choice VersaCAD Advanced, which is chock full of interesting and useful ideas and is a mature and stable product, is very impressive. Anvil-1000MD is unusually flexible in its catalog of entity drawing commands but runs on only a small selection of hardware. Anvil itself is extremely promising, especially given the manufacturer's large-system CAD expertise, but the PC version seems to require the addition of several functions to be complete (many of these functions are already in the pipeline.

and Anvil definitely hears watching) CADVANCE is less appealing. stallation and operation. CAD-VANCE is acceptable in most respects, but it simply fails to excite the PC CAD user. The low-end programs tested are a good value for the money, but that's about it. Even though they are easier to learn than the heavy hitters (and obviously cost less), most users would be better served by making the investment in buving and learning a more serious CAD program.

CADKEY That leaves the other Editor's Choice CADKEY. This CAD program was selected primarily for its three-dimensional capabilities. While AutoCAD, VersaCAD, and ANVIL offer some 3-D features, they are either cumbersome or so limited that they aren't useful for much of anything. CADKEY isn't the equivalent of a mainframe 3-D CAD either, but the 3-D functions are definitely usable and the program is well crafted and attractive in other respects. CADKEY is targeted for mechanical design and drafting applications and is a viable alternative to AutoCAD and a significant contribution to this market.

CAD hardware and software systems shipped will increase from 1,900 in 1983 to 32,000 systems this year and to 205,000 by the end of 1988.

PRICE/PERFORMANCE RATIO Personal computer CAD systems offer tremendous price advantages over minicomputer or mainframe CADs, bringing CAD within the reach of users previously unable to afford it, even though there are performance tradeoffs as well. Larger systems are much faster and usually feature much more capacious storage, but each generation of personal computer hardware and software is closing the gap. At this point, the generally accepted wisdom is that personal systems offer perhaps 70 to 80 percent of the features of larger systems at 10 percent of the cost-not a bad price-to-performance ratio.

The performance of personal computer-based CAD systems may completely meet the needs of many users. The biggest feature gap is in the area of three-dimensional representation. While PC CADs are beginning to incorporate 3-D features, current systems simply lack the computing power to perform real-time 3-D parts rotation, sophisticated solid modeling, and some other capabilities needed by some disciplines. Nevertheless, CAD for personal computers is big now and will grow dramatically

There are three broad categories of CAD products: software, hardware, and ancillaries. The following review sections reflect these divisions. The software and hardware review sections include features tables that enable you to make price/performance comparisons among the products. The products reviewed are a representative selection of everything available under the broad CAD umbrella. When you've finished exploring CAD, be sure to keep your eye on this technology. As the price/performance ratio continues to improve, new low-cost applications for CAD are sure to follow.

Glenn Hart is founder and president of his own computer consulting firm, Glenn A. Hart Associates, located in Monsey, New York. His specialties include business graphics and CAD applications.



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AD software is made up of a complicated set of drawing and editing capabilities. As in all things, the greater the number of features, the greater the power of the program.

The first step in creating a design is to actually enter its objects into the program. The list of 'primitives" or "entities" offered by CAD programs include straight lines, arcs and circles points, rectangles, ellipses, regular polygons, parallel lines, multipoint curves, and wide lines and curves. Free-form sketching

can also come in handy, as can the ability to create solid objects. You can usually locate

entities on the drawing several different ways. Exact coordinates can be entered from the keyboard, locations can be specified with the digitizer, and so on. Most programs offer several ways to define an entity.

Setting the scale of the drawing is vital in almost all CAD applications. The better programs allow you to work in almost any scale, as well as to change the units used.

Most programs offer both "grid" and "snap" facilities. A grid is a visual aid displayed on the screen that indicates intersections at regular, specified distances. Snap restricts object placement to specific locations arranged in a grid. An extremely useful feature is "object snap," which you can use to specify locations for automatic placement of the next entity.

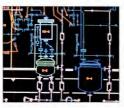
Other drawing aids place axes on the screen, display the current cursor coordinates, constrain movement to the horizontal or vertical, and allow other similar actions essential to the creation of a specific design. Some programs let you drag objects around on the screen. A zoom command increases or decreases

OMPLEX

SOFTWARE

THE PC

From 2-dimensional coordinates to 3dimensional renderings. Computer-Aided Design software is increasing the range and quality of the images that can be produced on a microcomputer.



the scale of the viewed objects. Pan allows you to move the viewing window without changing the scale.

Once you draw a design, you'll need to edit it. Two editing commands unique to CAD software are fillet and chamfer. Fillet ioins or rounds two lines with either a sharp or rounded line. while chamfer joins or chops two lines with another straight line.

Most CAD programs further include some form of layers or levels. A layer serves a function similar to that of an acetate overlay on a chart: it can be

displayed and plotted selec-CAD programs can store images on-disk that can then be in-

serted into other drawings. Many programs provide some structured catalog system to store block images. A good CAD program allows you to scale and rotate images while inserting a previously stored part. Macro language facilities add

power and speed. Some CAD software incorporates links to high-level languages like FOR-TRAN, Pascal, and C. and one. AutoCAD, includes high-level language features within the program itself.

The more powerful CADs offer attribute systems that attach text to individual geometric entities. This text can either be displayed on the drawing or maintained in an invisible database.

For the most part, 3-D capability on personal computers is primitive and limited, although programs like CADKEY are pioneering truly usable 3-D on small systems

CAD software stretches the boundaries of personal computer hardware. The following software reviews cover a sampling of products currently available and suggest what CAD is and where it's going.



PRODESIGN II

At \$299.95, ProDesign II from American Small Business Computers almost distinguished itself as the lowest-priced CAD program that PC Magazine Labs reviewed. We didn't expect it to have any competitors at that low a cost, but at the last minute-too late for a comprehensive review-a CAD program from Generic Software with the astonishing price tag of \$100 landed on our doorstep. (For a first look at this package, see the accompanying sidebar, "Generic CADD") Nonetheless, ProDesign II is fully an order of magnitude less costly than many other CAD programs.

My mind was preset to skeptical as I opened the ProDesign II package. How could any program this inexpensive compete with the behemoths that dominate the microcomputer CAD market?

The first surprise was the tremendous range of peripherals that ProDesign II supports. The list of printers and plotters that work with the program is more comprehensive than that of any other program we tested. The video adapter and digitizer selection is somewhat limited, especially on the high end of the more complex video cards, but even here ProDesign II offers more choices than many of the high-priced spreads.

HOW IT WORKS Installing ProDesign II was very simple, with a self-explanatory, menu-driven setup program (CAD-





ProDesign II offers a surprising list of features for its low price tag.

VANCE, at ten times the cost, should do as well!). The program's memory requirements are a bit on the heavy side for an entry-level package; it requires a 512K-byte system with about 475K free. You specify the parameters for most

commands by positioning the cursor and entering points with the numeric keypad or, optionally, with a mouse or digitizing pad. You can also specify points by entering exact x and y coordinates or a relative distance and angle.

Once you've chosen a point or series of points, you select the actual command by hitting one key at the keyboard. Since Pro-Design II has more than 26 commands, you use 10 Alt-key sequences, 18 punctuation characters, and the 10 function keys to issue commands as well. As with all such schemes, many of the commands are reasonably mnemonic, but many are unrelated to their function and consequently difficult to remember.

ProDesign II has a decent set of object drawing commands. Ares can be drawn either clockwise or counterclockwise. The Curve command can produce complex curves simply by specifying a series of points for the curve to pass through-a feature not included in AutoCAD. The Oval command creates circles or ovals, depending on whether two or three points are

specified. You draw lines with the Vector command; variable line widths and dotdash line patterns are available. Other commands draw rectangles, arrows, semicircles, and quarter circles.

The text facilities incorporate some interesting ideas as well. You can specify text size from a small fraction up to a value of 20 and text angle defaults. These values are completely relative; they have no direct relationship to any real-world size unit. Alternatively, when you place two points to define text boundaries and angle, ProDesign II automatically calculates the size and angles. You can also specify text location with four points; this lets you taper the text, depending on the position of those four points.

Two fonts are available: a rather ugly one composed of only straight-line segments, and another with a rather plotterish style that isn't particularly attractive either. Text can be hidden from view to speed up certain operations.

DRAWING AIDS ProDesign II's repertoire of drawing aids includes three types of grids: full intersecting horizontal and vertical lines, axes along the edges of the drawing, or dots. The Snap function is simulated by changing the cursor's "step rate" to a given number of dots. Vertical

■ ProDesign II's zooming method permits scaling and rotating of the section

selected

and horizontal dot spees can be different.
Unlike most CAD programs, ProDesign II all the properties of the properties o

points is probably better overall.

and y coordinates on its status line, much like other CAD systems do. In addition, you can set the status line to display simulaneously the x and y coordinates, the angle, and delta-x and delta-y in relation to a set point. You can change the cursor to crosshairs instead of 1 its normal "X" shape. Other useful ProDesign II sechniques are the tubberband mode (used to

ProDesign II can display the current x

connect to the previous point as objects are being drawn) and the rubberband box mode (to draw a window box as you select the two points that define an area to work with).

ProDesign II's zooming abilities are flexible and interesting. The normal zoom procedure is to specify two points and a magnification factor (greater than I for magnification and less than I for enlargement). You can also select zooms with four points; this method permis scaling and rotating of the section selected as the zoom is execution.

EDITING COMMANDS Many common object-editing features are included. Unfortunately, one of the important ones, Erase, is seriously flawed. Erase works only on the original endpoint of an object, not on any point on the line. Although Pro-Design II does have other ways to assist you in finding the original endpoint, this nonintuitive design is a weakness of the

program. ProDesign II's other editing commands are better. Both the Undo and the Cops commands, which are the reverse of one another, protect you from inadvertent deletions. You can delete a section of the drawing. You can move or copy a window section, and ProDesien II can scale or rose.



CAD Software Capabilities

This chart indicates which drawing, edding, and other features each package offers. Only intrinsic features are given e dot (for "yes")—not work-erounds. For example, some packages can draw parellel lines directly, while others either require a miscro can't do parallet fines at all (ofter than main-uity) postitioning the lines very carefully).

Most of the items are self-explenatory, however, here are some brief comments on e few of the items.

Auto line closing allows the program to

create e closed polygon by connecting the current endpoint of a multipart line to its origin. Polylinea are aingle entities that combine straight and curved segments, some of

straight and curved segments, some of which may have varying widths. Auto-aligned test means that the program calculates character size to lift the tast between two specified points.

Snap and Grid aspect refer to snap and gnd spacings that are different elong the vertical and horizontal axes.

and horizontal axes

Angle anap refers to a anap grid that is rotated a specified engle from the normal elignment along the x axis

Object snap one time describes programs thet cen set some form of object snap for the next location pick, as opposed to those which can turn on a snap mode continuously. Segment fine arc breaks an entity into smelter entities that you can then merupulate.

Curzor Icons ere small symbols that appear adjacent to the cursor to indicate the type of entity or editing action that will take place. Page display shows that drawing is done on one standard-sized page of paper at a time, with multiple pages used to create larger.

Grawings

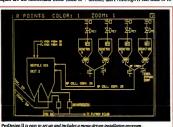
Baseline and Continue dimensioning de
scribe several dimensioning lines that relate
to a given starting point or chenge the scating point along an entity, respectively.
Side shows are rapidy displayed sequence
of stored images, useful for other presenta-



Entity drawing commands

tions or demonstrations.

Auto line closing Continuation Wide lines Parallel lines





ProDesign II is an entry-level CAD program that incorporates some original ideas.

tate it when you specify more than one move point. An entire drawing can be rotated as well. A Paint command can fill in closed objects, although only with a solid color (no pattern-hatching provisions are available).

"Gravity" modes map a point exactly no top of another point nearest to it, which no top of another point nearest to it, which is Probestign II's only claim to a form of object snap. Another command changes the location of a point and any objects linked to that point—a powerful and flexible tool. Probesign II has a Change Color command, but it, too, works only on an object endpoint. An Ortho command forces lines to be perfectly horizontal or vertical.

ProDesign II does not include layering in the sense that not other CAD programs do. A command loads a drawing and dispays in while not including it in the durrent drawing, so you can view more than one drawing superimposed in position. You can simulate layering by loading drawings on top of each other using the normal file-retrieve command and then plotting or printing the accumulated images. This cumbersome procedure is not at all as versatile as true lavestale as true lavestale as true lavestale as true lavestale as true lavestale.

Other file management commands save a specified section of a drawing to create symbol blocks. A drawing can be scaled or the file layouts used.

rotated as it is read from disk—a procedure you can also use for block operations.

ProDesign II claims to include autodimensioning, but the feature is printitive at best. The program can simply calculate the distance between two points and display the distance between two arrows. None of the complex dimensioning features; like angular dimensioning, leader lines, baseline, and continuation dimensions are included.

GOOD PRINTING RESULTS Printing and plotting are smooth and trouble-free. ProDesign II's developers were obviously hard copy even with rereating good-quality hard copy even with inexpensive dot matrix printers. The results the package can produce from low-end printers are truly surprising. Plot sizing to exact scale is possible, but the cumbersome method requires manual calculations.

ProDesign II has a limited help system, including basically only a list of the available commands. The help is not context sensitive. The program supplies a command summary sheet but not a function-key overlay, which should be part of the package.

The documentation, clear and to the point, goes to unusual lengths to explain the file layouts used.

UTILITIES Some remarkable utilities are included with ProDesign II at no extra cost. One program can import normal AS-CII text files for inclusion in a drawing. It can also use files compatible with the ubiouitous Hewlett-Packard HPGL graphics language. To do so, it needs a text file containing the HPGL instructions created by some other graphics program. ProDesign II can read in this file and manipulate it like any other drawing. Also, a translator converts ProDesign II drawings to IGES, a graphics interchange format widely used in minicomputer and mainframe CAD systems. This utility opens the door to upward migration of ProDesign II drawings.

ProDesign II has an impressive array of features—for less than \$300' The program is very easy to learn, and you can produce results much sooner than with more complex CAD programs, although you may miss some more advanced features as you gain proficiency and sophistication. Pro-Design II clearly doesn't threaten Auto-CAD and the other heavy hitters.

A note supplied with the program claims that some of the largest corporations use ProDesign II (AT&T, American Adrines, Bank of America, Bossing, Dow Tunn, 18M, Lockbeed, Motroola, NASA, Standard Oll, and 3M), American Business Computers (a missomer in light of sales to the above?), developer of ProDesign II, attributes its success in selling success the companies to the program's best companies to the program of the pro

Though certainly easy to use, ProDesion II does have some weak points-its user interface isn't exactly my cup of tea, no attribute system is supplied, many of the other systems are rather limited, and the program lacks elegance in many areas. Although I personally would not exchange my high-end micro CAD software for Pro-Design II, the package does have a surprising amount of functionality and a sprinkling of very interesting ideas. When I first encountered ProDesign II, I wondered whether a true CAD system could be possible for \$299. The answer is absolutely yes. ProDesign II can meet your entry-level CAD needs at a bargain price.

CADKEY

Many writers have drawn an analogy between CAD systems and word processors. One processes images the way the other processes text. I find another analogy release are counting packages. Both often special markets with particular live to appeal to mandes with particular face to appeal to mandes with particular from finer Control Systems of Venno. Connecticut, a mechanical engineer of CAD package that offers three-dimensional canabilities.

A generic accounting system may have redvance to many businesses, and a general-purpose CAD program may be suitable for many design and drafting targets. But just as many disciplines need customized accounting packages, segments of the CAD market may need specialized CAD programs like CADKEY.

Mechanical design is one such area. Mechanical engineers are using broad CAD programs like AutoCAD, CAD-WAVEE, and VersaCAD, and the darries productivity such programs provide all put mechanical engineers need to design 32 well but mechanical engineers need to design 32 begate that will be machined (often by machined) and the such as the su



for CAD programs, like CADKEY, with unusual canabilities.

The 3-D requirement pass a heavy bear on most microcomputer-based CAD programs. Some 80 percent or so of maintaine and minicomputer CAD systems sold are true 3-D systems, with true 3-D systems and are true 3-D systems, with true 3-D and true 3-D systems and more. But most micro-based CADs have no 3-D ability, even though Auto-CAD and Avni-100MD have mader principles. The control of the system of the syste

PINTALLING TRUE 3-D The only true 3-D CAD system reviewed here, CAD-KEY has all or most of the features offered by competitive 2-D packages and some interesting approaches as well; it is also satisfactory for normal drafting use. CADKEY is not intended to be a general package, however. Its target is clearly mechanical engineers.

engineers.

Most of CADKEI's functions work in
3-D as well as 2-D by specifying a r coordinate as well as the normal r and y coordinate as well as the normal r and y coordinates.

CADKEY has specialized tools to work with 3-D parts, ranging from a fluxible rotation and viewpoint system to generation of wire meshes needed by external finite-element analysis programantsysis programantsysis programantsysis programantsysis programs.

Installing CADKEY is straightforward, except for one difficulty: The ANNI SYS screen driver can not be present, a fact the manual fails to mention. CADKEY's range of support for video adapters, digitizing devices, and plotters is reasonable, if not as extensive as some. If's copy protected, but by a reasonably painless hardware device inserted into the LPT1: a purallel port.

NYERFACE MCS devoted a great deal of development time to CADET's user interface. It uses a ferred menu structure similar to that of most other CAD programs but with a few interesting wrindset with a few interesting wrindset some research shows that, since to people read from left to right, this system people read from left to right, this system is easier to use. No more than ten menu options are displayed at any one time. You can use the digitizer, a mouse, or the PC's function keys to select from the means.



A minor quibble: CADKEY uses no multiple digitizer or mouse buttons; every button merely issues the package; 8 Pick command. While its relatively few displayed options sometimes require you to make a few more picks than with programs that display many more options at one time, MCS cites research showing that most people can readily assimilate no more than seven to nine options at a time.

In addition to its menu system. CAD-KFU sues an "immediate mode" to let you issue program commands while executing other commands. Most CAD programs have a handful of such commands, but CAD KEV takes the concept to new lengths. You can issue 28 commands in this manner through Crd or Ak key sequences. The commands are not particlarly mamonia, but MCS gives you a plastic reminder card for the keyboard.

Below the menu area, the CADKEY screen also displays the current settings of several parameters. An excellent history line at the top of the screen shows who commands and options have been issued recently, an especially helpful feature when returning from immediate-mode instructions. Interactive prompts appear at the bottom of the screen. Some commands

that might accept digitizer input on other systems require numeric input in CAD-KEY, but this requirement is consonant with the precision and lack of "eyeballing" inherent in mechanical engineering. Such commands must be terminated with the Return key; the Space bar, much easier to find, would be a better alternative.

Overall, the CADKEY interface is very

CADKEY uses an

"immediate mode" to let you issue program commands while executing other commands.

good. After a little practice, you can navigate around the command structure quickly and painlessly. You indicate screen picks with a rather large X, somewhat less useful than AutoCAD's alignment blips. The cursor is normally a smallish crosshair, but you can enlarge if if you wish. CADREY indicates picked objects with a triangular symbol, a useful method with the wide range of object snap modes that are intrinsic in the entity creation process.

The package has no dynamic drag mode—a distinct drawback. One command (Transform Absolute) simulates drag to a degree; 3-D drag is a more directly proposition than 2-D. While moving objects around by eye is not as critical in mechanical work, a drag function might still prove useful during the early stages of conceptualizing a design.

DRAWING CADKEY's entity drawing commands are good. It can draw lines in several ways, including parallel lines, vertical and horizontal lines (although there's no orthogonal constriction system per sol, perpendicular and suggest lines as merely drawing another kind of line rather than as exparate samp ofton. CADKEY has a wide range of object snap provisions, even the ability to snap to a point at a distance you specify along another entity. An inter-cating Angle option constrains lines to

CADKEY has a sketch mode, but the line increments are fixed and are a little too coarse (mechanical engineers are unlikely to use this option much anyway). A Mesh command designed for finite-element analysis programs takes the space between two objects and "discretizes" it into a number of straight lines.

CADKEY can draw arcs and circles in several ways too, including tangent to one or two entities. Rectangles and polygons of any number of sides can be drawn directly from menu entries rather than through macros.

EDITING One of CADKET's best features its tsuperfilleding system. It can fillet both lines and arcs/circles—a most amount appealing. A Trim/Nortim option amount appealing. A Trim/Nortim option that the contract of the cont



works in a similar manner but with userspecified sharp-cut distances.

Trim is an extremely powerful related command for both trimming and extending objects. The variety of possible effects is excellent.

CADKEY has both Delete and Recall commands. The Recall command can bring back everything deleted in a session.

■ CADKEY's Trim function is an extremely powerful command for both trimming and extending objects.

CADKEY's selection system can pick entity types as well as single and multiple objects or windows. You can specify masking to exclude layers and other entity

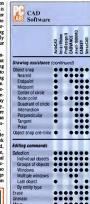
The package's dimensioning system is quite flexible. A few features are missing, most notably Baseline and Continue options, but it's simple to work around them.

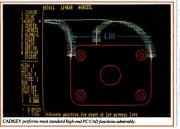
The Notes command is the text creation mechanism. Entering or positioning text is easy, but changing the height, slant, or font requires extra steps from separate menus. Labels are like text, but with arrows—a handy feature for annotating farwings quickly. CADKEY offers only two text fonts, but boldface is available for emphasis.

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Other editing commands include Move, Copy, and Join, all of which work in 3-D, and a powerful Change command, which modifies text characteristics (angle, stant, height, font, and position), decimal precision, witness line and arrow characteristics, tolerance display, scanne display, scaling, and so forth. The Attribute command can change color, line two far anther limited selection









with no provision for user-definable line types), pen number, and line width,

Wide lines are only for screen display, CADKEY cannot plot wide lines (not to mention a more complex task like plotting wide curves). Mechanical engineers may not need wide lines as often as some other users, but the lack of wide-line plotting is a drawback that CADKEY's developers should remedy.

PROGRAM PLUSSES CADKEY's nomenclature for drawings and blocks is Parts and Patterns, a common naming scheme used in larger CAD systems. The package has flexible provisions for maintaining libraries of predrawn objects.

taining libranes of predrawn objects. Another excellent CADKEY system allows you to see a 3-D part from any viewpoint. CADKEY predefines a half-dozen or so common viewpoints, but it lets you specify an unfailled numerion of the prediction of the control of the prediction of the prediction of the control of the prediction of the control of the prediction of t

CADKEY can zoom to a window, to a specified magnification or reduction factor, or to "half" and "double." An Autofit option rescales the drawing to fit the display. The program can also store three zoom nesting levels to return to a previous zoom. The Pan command moves you to a specified centerpoint-a not particularly convenient system. All is well if the desired center point is visible, but if it's not, you must type the center coordinates at the keyboard. Admittedly, the immediate mode commands make panning less necessary than with some other programs, but a pan displacement provision would be a useful addition.

You can set CADKEY's Grid option to match whatever Snap option is in effect or, alternatively, match the Snap to the Grid. Many CAD users prefer to have the Snap and Grid identical, and this provision makes it easier to do so. Both the Snap and Grid options can be aligned with a point for extra flexibility.

CADKEY has 256 available levels; you can always turn specified layers on or off. Entities can be moved from one layer to another. CADKEY allows any mixture of



line types or colors on a level, unlike many competing packages, which demand assignment of only one color or line type per

A powerful Verify system displays entity data. It shows coordinates in both

 CADKEY includes bidirectional interchange with Autodesk's DXF format

World and View schemes as well as "sweep angle," radius, start and end angle, and start and end points in both coordinate systems. CADKEY can calculate distances, areas, perimeters, and even a moment of inertia. CADKEY lacks volume computation, however; this omission seems a bit strange for a 3-D package.

PLOTTING FEATURES You plot drawings using an external program rather than from within CADKEY itself. CAD-KEY writes a file to disk, which a program named PLOTFAST plots. MCS feels this

method is advantageous because it allows the plot file to be edited and plotting to be done "off-line" while you continue to design. PLOTFAST chooses between plotter types (only Hewlett-Packard and Houston Instruments DMPL types) and selects pa-

per size, origin, and so forth.

One significant plotting feature allows you to specify the sequence in which entities will be drawn rather than plotting in the order in which they were drawn. This is essential in numeric control applications where, for example, machine-tooling cutting instructions must be given in a precise order.

CABL LANGUAGE. The newest version of CADKE's includes MCS's CADL language. CADL is a new BASIC-like language that consists of executable command files, somewhat akin to dBASE's program system. CADL is still in its formative stages and will grow over time. It will permit you to input and output 3-D geometry as well as automate some setup and drawing tasks.

CADKEY has also added bidirectional interchange with Autodesk's DXF inter-change format. This addition allows you to load AutoCAD 2-D drawings into the 3-D CADKEY domain. Some third-party Auto-CAD support software that uses the DXF.

mechanism may work with CADKEY as well.

A separate IGES transfer module, available for S750, is a bidirectional utility that outputs and accepts full 3-D drawings. IGES is a 3-D standard by definition. Other micro CADs that claim IGES compatibility are, therefore, misstating the case to some extent.

FASCINATING TESTING My tests of CADKEY proved to be a fascinating experience. Using CADKEY strictly as a 2-D system, I found the program to be a worthy competitor to the other serious CAD packages reviewed here. The user interface becomes more and more powerful as you learn the immediate-mode commands and leave the menu system behind. The ready access to so many commands without leaving an executing instruction gives you a lot of power. After you become accustomed to CADKEY's flexibility, some of the other systems with no or limited immediate-mode commands seem very cumbersome by comparison. CADKEY also shines in its object snap, entity selection system, and, especially, its wonderful fillet capabilities. Of course, as with any complex program, you can find things to carp at, but overall CADKEY's basic performance is very fine.

Very simply, CADKEY can do things none of the other packages reviewed here can do. The real power of the program energes as you enter the 3-D realm: Working in 3-D is not much more difficult than 1-2D. CADKEY's Transform command creates 3-D parts in a flash, and the View and Mesh commands, true 3-D filleting and chamfering, and other 3-D commands are both simple to use and powerful.

CADKEY does a good job as a general purpose 2-D program. but architects, circuit board and schematic designers, surveyors, and many others who find Auto-CAD, CADVANCE, and other general purpose programs assisfactory may be well advised to stock with these programs. For mechanical engineers, however, CADKEY meets its design goals administration of the control of th

ANVIL-1000MD

In the world of mainframe and minicomputer CAD, Manufacturing and Consulting Services (MCS) is a 15-year-old heavyweight. Its president and founds to be the father of CADICAM, and its An-wi-5900 is one of the most advanced three-dimensional systems available. MCS has now expanded its product line to the PC environment with its new Arnel-1000MD.

environment with its new Anni-1000ML
Anni-100ML is designed to operate
on the IBM PC AT. Although MCS has
positioned its CAD package for the PC as
"directed to mechanical drafting applicates," the product's manual suggests that
it is also appropriate for architecture, engineering, construction, process control,
electrical work, and the other general CAD
markets.

INSTALLATION Installing Arriif was softbit of a problem. The program uses soft-Lok protection, which worked normally, to lony one installation is dated into the protection counter. Once all the files were then promptly blanked the screen and died, hanging the computer. After much experimentation and calls to the MCS technicalsupport department, I found out that the was installicent the custom of the state of was installicent the custom of was installicent was installicent and wouldn't work until the counterpartment of the counterpartment of memory branger and wouldn't work until



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had removed everything from my CON-FIG and AUTOEXEC files and reduced the number of file handles and buffers I normally use. While the memory-resident programs aren't needed while running Anvil itself, Anvil is the first program I've used that really must have a full 640K bytes of RAM (less DOS, of course) available to it.

DISPIALY Once past this hurtle, Armit awards with a tower with a tower with a colorful display screen. Armit supports only the IBM Professional Craphics Adapter, but I used a Verticom M-256 video controller that as tooh much faster and less expensive than the best to emulate the PGA and is soon much faster and less expensive than the PGA. It's a 25-60ctor version of the Verticolar of the

Anvil uses different colors for many different areas of the screen. You can select your own preferences from an elegant little spectrum display that's a model for how colors should be chosen. The display looks a little garish at first, but using the color palette quickly becomes comfortable, and the program constructively uses the extra differentiation the color provides.

USE OF THE KEYBOARD Anvil uses any other CAD programs. You select the functions with the opportunities of the opportunities with the opportunities of the opportunities with the opport

MCS provides a detailed keyboard overlay for both XT and AT keyboards. Anvil uses a system of "implicit points" for object snap; you select the type of point you want by typing a key—yet another feature that ties you to the keyboard.

Anvil's first releases worked only with a Kraft joystick connected to a game port, a rather bizarre setup for a serious CAD sys-



ANVIL-1000MD offers beautiful use of color and unusual flexibility.

tem. The new Revision 2, which I also tested, supports a half-dozen or so digitizers; MCS supplied a prototype tablet overlay, which proved a bit critical to configure but otherwise worked well. The screen digitizing area is rather small, but MCS says it was designed for full-screen resolu-

 Many of ANVIL-1000MD's curve-drawing functions offer unusual flexibility.

tion with minimal hand movement. Using the digitizer removes some, but not all, of Anwi's tight linkage to the keyboard. It also enables a macro learning feature, which saves keystrokes and assigns them to unused boxes on the digitizer.

No special area of the screen is set aside for the menus, which appear on the left side of the regular drawing area. The menus can obscure drawing information beneath them, but they can be turned off to reveal the hidden detail or in the rather unlikely event that they are no longer needed.

This design does allow the drawing area to be larger, though. No on-line help system is available, but a "tutor" line at the bottom of the screen assists you somewhat (when you no longer need it, you can turn it off).

Slow updating of the screen seems to hamper your entry of text. But when you speed ahead, no characters are lost; the screen merely catches up when it can.

CURVES AHEAD Many of the curvedrawing functions offer unusual flexibility. Chamfer and fillet are extremely powerful, for example. The Easy options perform the most likely adjustments very simply, but a full arsenal of exacting options is also available. You can segment curves into smaller parts and quickly produce tangents to two or even three curves. You can also add various types of arrowheads to the end of any curve, and much more. The package allows direct drawing of multipoint splines, offset curves (like parallel lines, but it also works on arcs and closed polygons), triangles, rectangles, ellipses, hexagons, and "strings" of continuous curves. The program has flexible closing features to close line strings in various ways.

You can add special intrinsic symbols to indicate surface finish (with associated



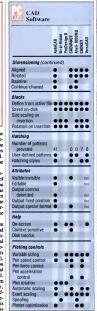
text to indicate roughness value, production method, sampling length, direction of lay, and machining allowance). Another set of intrinsic symbols indicates geometric tolerance.

Anvil's "modals" sections set characteristics for many system entities. The text modals section, for example, determines such attributes as text height, width, spacing, angle, tolerances sizing, how text locations are specified (via the cursor, keyboard coordinate entry, or delta from a specified location), automatic sizing to fit between points, centering, justification, whether the text is considered attached to the paper (dimensions or notes) or to the geometry itself (a panel marking, for example), and whether to use proportional or fixed character spacing. You can specify similarly flexible settings for arrow positioning, sizing and type, how witness lines are constructed, hatching spacing, every aspect of the dimensioning system, and so forth. An editing system allows you to change the modals assigned to entities and modify text entries.

DIMENSIONING AND OTHER FEA-TURES The package's dimensioning system is first-rate. Anvil supplies a full complement of dimensioning tools, including radius, angle, diameter, baseline, chained, and ordinate, in addition to the normal horizontal and vertical dimensioning. Base and continue dimensions can be performed on angles. The dimension lines can be jogged for more visual appeal. Overall, the dimensioning features are one of Anvil's best subsystems.

Crosshatching is somewhat less impressive. Hatching patterns consist only of lines, with no prodefined patterns. You cannot define special patterns. Arvil has no intrinsic hatching styles for complex nested objects. You can get it to hatch the objects you want, but a long series of cursor picks may be necessary to outline boundaries carefully.

Anvil's entity manipulation features are generally excellent. A terrific Trim/Extend command offers unique and useful techniques to manage objects. An unusual Separate command creates openings in objects. Other commands move objects (making copies to other layers if desired). translate, rotate, and scale objects. You can select objects to be deleted several ways, including by entity type or level, Unfortunately, no "undelete" mechanism is available; when objects are gone, they're gone for good. Although unintended deletions are prevented by the requirement that you confirm every deletion, this process can get annoying and is much less





desirable than an undelete system.

With Anvil, you can define line types (confusingly called fonts), set the characteristics of objects to the current defaults or to match the characteristics of specified objects, and much more. You can specify line "weight" (width) to match the pen width stal will be used in the plotter or to a width you specify. Changes in width are disbalwed on the screen, as they should be.

You can use up to 1,024 levels, more than most micro CAD packages allow. Levels are numbered only, not named. A layer can include objects with any colin to type; there are no restrictions, such as one color per layer. Arm? I slevels are especially powerful; they let you copy objects easily to ranges of levels with your specified level number increments.

The Anvil grid system can display either standard rectangular grids or isometric grids. The grids are horizontal and vertical lines rather than dots. The grid also serves as the snap mechanism, turning a grid or distinct from merely displaying [s) inees fine this feature more intuitive than a pearing grid and snap pacing, although it's more flexible if you can set the grid and appare grid and snap spacing, although it's more flexible if you can set the grid and snap to individual specings. The grid system also allows the cursor to roam within any points rather than move directly from

snap to snap point. This design can lead to some confusion, especially if the grid happens not to be displayed.

pens not to be displayed.
You can specify zoom by magnification/reduction scale or window, and the window can quickly return to the base scale, or Anvil can calculate the best fit for the objects in the drawing and fill the screen. The pan feature uses either a now center point or della coordinates for repositioning the viewing window. Flexible blankinghumblanking provisions can turn entity types, levels, ranges of levels, and so forth oan and of

While Arvil's manual clearly states that the program is a 2-D system, the package includes various commands to "give other views of a model by implying a third dimension." These provisions are more powerful than the limited 3-D in AutoCAD

but not as flexible as those in CADREY.

AmVI'S inquiry system displays gottem displays gottem displays gottem displays gottem displays coulate the perimeter, unex, and moutant gottem and mali of gyration of closed objects. These features are highly useful mechanical work. AmvI's File Management system loads and saves charwings as the same merging drawings from disk with the current image, incorporating scaling and carbon. You can use either these provisions or a similar Figure yestem load also also set only a similar Figure yestem load also also.

of predrawn parts, although this method is less flexible than that of the library features some other CAD programs offer.

PLOTTER SYSTEM Anvil does not drive pioters directly. Instead, a compact joint file is written to disk. From DOS, this file is processed by a postprocessing ground that "ours" the plotting instructions to optimize pen movement, a technique that can rotate plot times up to 60 percent or so. A separate processor roygram is propost. The result is a file that can be "print-ed" to the plotter using the DOS PRINT command. PRINT can spool a series of files to a suitable plotter in the background. allowing the computer to be used for more

work.
Even MCS calls this process "cumbersome," but it does offer some advantages.
The Anvil plotter system doesn't allow very much control over the details of the plot, but the system works reasonably well otherwise.

HANG-UPS AND OMISSIONS My tests of Anvil were pleasant but as bit problem prone. In addition to the difficulties I have already mentioned, the system hungs are all present and perations. Earlier versions of Anvil evidently were prone to such behavior, but MCS feels the 8-MHz clock rate of my AT, either by itself or in conjunction with the Verticours, may have contributed to the problem. I did not experience any hange updaing the test period operating at 6 MHz, and so AT speed demons may be Colock rate with bits morerum.

Something remarkable happened after these hang-ups. When Anvil was reloaded, it asked whether the aborted work should be recovered and proceeded to restore the drawing to its previous state. This feature is a remarkable safety net for system malfunctions, nower failures, and the like.

Strangely, the system uses no rubberbanding anywhere (when windows are specified, as entities are drawn, and so forth), nor does it do any dynamic dragging. These niceties are not solely missed

but would be attractive enhancements.

Anvil's other omissions are somewhat



more serious: It has no attribute/bill of materials system. And, although sketching is not as critical to mechanical drawing, it could be useful in the early design and concentualization stages: but Anvil allows no free-form sketching. Also, the package does not include a macro language or other programmability, but MCS plans to add them in the near future.

KUDOS The MCS documentation deserves commendation. It is beautifully written and extremely detailed. Production quality is first-rate, and copious examples are provided.

Anvil can easily handle very complex drawings. Written in FORTRAN and a little assembly language, it is noticeably faster than some competitive programs. Some of the sample drawings provided contained over 10,000 entities, yet displayed in under a minute. The sample drawings were unusually beautiful, taking full advantage of the magnificent display capabilities of the Verticom M-256 video controller and monitor.

MCS offers two optional bidirectional conversion programs that convert Anvil-1000MD drawings to either IGES format or the format used by larger Anvil systems. Both programs cost \$995. Linkages to numeric control programs are also available at additional cost

The basic Anvil interface is not particularly my cup of tea. It is rather strongly linked to the keyboard, although the new Revision 2 and its digitizer template are much better in this regard. But mechanical users tend to specify a greater percentage of their input with numeric values rather than by eye, and so the emphasis on the keyboard is, perhaps, less significant.

The mechanical design orientation of the program comes through strongly. While the product is not totally inappropriate for users in other CAD categories and the marvelous use of color and highly flexible entity drawing and manipulation features apply to any discipline, Anvil is not an especially strong general-purpose CAD. You may miss 3-D when using this package, but if you do mechanical design or drafting, you'll find that Anvil-1000MD is a fine product for your needs in many ways.

VERSACAD ADVANCED

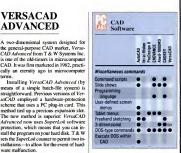
A two-dimensional system designed for the general-purpose CAD market, Versa-CAD Advanced from T & W Systems Inc. is one of the old-timers in microcomputer CAD. It was first marketed in 1982, practically an eternity ago in microcomputer terms.

Installing VersaCAD Advanced (by means of a simple batch-file system) is straightforward. Previous versions of VersaCAD employed a hardware-protection scheme that uses a PC plug-in card. This method tied up a precious expansion slot. The new method is superior, VersaCAD Advanced now uses SuperLok software protection, which means that you can install the program on your hard disk. T & W sets the SuperLok counter to permit two in-

ware malfunction. The current release of VersaCAD supports more peripheral devices than did earlier releases. The package supplies a good selection of video systems and digitizer options, although it supports only Hewlett-Packard, Houston Instruments, and Cal-Comp plotters. Its matrix printer support is limited to Epson and compatibles.

INTERFACE VersaCAD Advanced's user interface takes full advantage of the PC's hardware; both function keys and





control sequences are used to issue commands. A chintzy function key overlay comes with the program. You can select options, which are displayed in tree-structured menus along the left side of the screen, with the digitizer, a mouse device, or by typing one letter at the keyboard,

A status line at the bottom of the screen displays cursor coordinates and the current state of several system options. These displays are a bit cryptic but become familiar quickly. Three more screen lines are used for operator prompts and informative displays. The screen cursor is either a small crosshair or crossed lines extending to the screen houndaries

On the excellent Verticom M-16 video system used for this test. VersaCAD uses no color to differentiate the menu areas, status lines, or other screen areas. The setup program includes provisions for specifying colors for several portions of the screen, but for some reason, they don't work with the Verticom. Presumably VersaCAD used color to better advantage with some other color adapters.

Moving from menu to menu is not particularly smooth. One annoying feature of the program is that you cannot use the digitizer or a mouse to make menu selections



while in the middle of a graphics command. In this common situation, you must hit he appropriate key on the keyboard—a method slower and less convenient than simply picking a suboption with the digitizer or a mouse. This requirement also the you much more closely to the keyboard than necessary.

man hecessary. The use of single-letter commands and VersuCAD's compatibility with keyboard macro programs like ProKey do give you a way to enhance frequently used command commands with unction keys, while the program is performing other commands. Overall, the VersuCAD interface is not quite up to the best of the competition, but its perfectly usable.

GOOD IDEAS VersaCAD's developers have incorporated excellent ideas into the program, now in its fourth major release. The maturity such longevity contributes is

clearly visible. Entity drawing has its share of useful touches. For example, the program can draw lines at producined angles or rotate lines as they are drawn. It can place a mark may be considered to the commands are readily accessible. Versamow heads to the end of any line. Ortho commands are readily accessible. Wersamow heads to the end of any line. Ortho commands are readily accessible. Wersamow heads to the art of a line, which remain only until the drawing is regenerated, as well as template lines, which are similar temporary drawing aids. Both are similar temporary drawing aids. Both support of the producing and the support of the supp

The program can draw circles, ares, directly. It can draw smooth Bezier curves as well. These curves are lovely, although T & W's claim that they can replace frehand sketching (which VersaCAD doesn't provide) is a bit of an overstatement. The program uses fast dynamic dragging throughout for easy visualization.

Text facilities are reasonably good, with flexible editing provisions and the ability to change size, rotation, justification, and other characteristics. You can import text from word processing files. VersuCAD can use only one font in a drawing—a definite limitation—although you can use an external program supplied with the sytem to define new text forthe new text forther new text forther new text forther new text forther systems to define new text forther new

VersaCAD includes dimensioning, but the system is limited. You must manually insert dimension text into a break in the dimension line; if it doesn't fit, you must issue a series of commands to resize the text. Only linear dimensioning is available, with no automatic dimensioning of angles, circles, or arcs.

EDITING FEATURES The program has all the standard editing features common to PC CADs, as well as some unique

 The maturity that VersaCAD's longevity contributes is clearly visible in the program.

concepts. Objects to be edited are first selected in various ways. VersaCAD allows you to group objects together under a name and then manipulate them as a single entity. You can define groups by line type,

level, and other criteria. Selected objects "strobe" or "blink" on the screen. This indication is visually more powerful than changing either the color (which can be confusing when colors are used for other purposes) or the line type to dotted (also potentially less obvious). Moving, copying, rotating, scaling, and so forth are smooth and easy. The Copy command also creates rectangular or circular arrays very simply. VersaCAD can mirror objects around oblique axes as well as merely horizontally or vertically. Versa-CAD's Update command is unusually powerful. The program can change a long list of entity characteristics, including line style (giving you a choice of eight styles), density (the number of times the plotter will repeat the entity, similar to doublestriking on a word processor), line widths in 1/64-inch increments, level, and so forth. You can also select these options with a function key; the program will then apply them to all entities drawn thereafter. Strangely, the system does not show wide entities on the screen, although they will

be plotted correctly. This situation could lead to some problems with clearances in dense drawings.

Windowing commands are flexible as well. In addition to moving the view in and out, VersaCAD can return to the base window or resize the drawing to fill the screen. Panning is also possible. You can save named window specifications and retrieve them from disk for immediate access of part of a drawing.

VersaCAD can construct libraries of symbols. A 10 by 10 matrix stores 100 symbols in a given library. Each symbol is created as a separate drawing and then added to one of the cells. The program creates an attractive plotted overlay for the digitizer to allow quick selection of an individual symbol. If you use a mouse or a keyboard, you can refer to the plotted library and enter symbol numbers. The program can scale, notate, and mirror symbols as they are inserted into a drawing. A global scaling factor can be applied to all inserted symbols. To reduce drawing time, the program can represent symbols only as outlines rather than with full internal detail.

VersaCAD's versatile "construct" menu includes such capabilities as extending and trimming entities, "filleting," creating parallel and perpendicular lines, and more. The Extend function, which also trims, can work with projections as well as actual lines. It can display the various alternative trims before actually executing them-a clever and useful feature. The Fillet function works on both lines and arcs, circles, or ellipses. Parallel line creation is fast and flexible; you can even create "nonparallel parallel lines" by specifving a rotation for the new "parallel" line. VersaCAD can create tangents to one or two circles.

One of the program's drawbacks is that entities that are picked in these functions are not designated on the screen in any way, and this situation can make it difficult to be sure that a desired object has been selected. Another drawback is the lack of a chamfering function.

SNAP AND GRID VersaCAD's snap and grid systems are good. You can define different vertical and horizontal increments. You set the snap by specifying the cursor increment, the distance that the cursor can move along the x and the y axes (the distance for each can be different). Object amp is available for the end or midpoints of lines, eight quadrants, and the center of of an arc, the conners or center of or factunetic control of the control of the conlegies, vertices or the center of polygons, and so forth. Object salso have "handles" for moving or rotating, and VersaCAD can any to them as well. Object salso pace and also choose an object s" equals to," which alsies—an interesting and useful to obtain size—an interesting and useful to obtain

The package can hatch areas with lines positioned at user-specified angles and spacing, It supplies no predefined hatching patterns, and it cannot define patterns other than lines. VersaCAD's documentation suggests using very closely spaced lines for solid fill, which is unavailable as a spenate command. The program can store any combination of colors or line types on any of its levels. This makes VersaCAD far more flexible than programs that mandate that only one color or line type can ap-

pear on a given layer. VersaCAD can calculate the area and the perimeter of irregular objects. You can specify how many "slices" the program should make while performing these calculations. More slices give a more accurate result but take slightly longer. Other CADs that can work with irregular objects probably use similar algorithms but don't allow you to specify the precision. Perhaps more importantly, VersaCAD can also determine several cross-section properties that are essential to some mechanical design applications, including moment, center of gravity, moment of inertia, radius of gyration, and section modulus.

gyration, and section modulus. The linquity system is equally flexible. The program offers an unusually long his the control of the program of the system of the control of

ADEQUATE PLOTTING AND HELP Plotter control allows you to adjust a drawing to a specific scale, select the area to be plotted with a window, save and retrievtors, and the plotting instructions continuous control of the plotting instructions control of the plotting instructions control of the plotting instructions propage and plotting instructions of the plotting participations, but overall, the plotting system is adequate.

On-screen help is available at any time. It is not context sensitive because you must manually select which option you need information on, but it is reasonably convenient nonetheless. The clearly written help screens explain the chosen operation and how to use the available options.

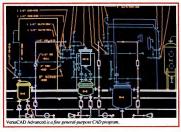
CAD users know it is easy to get caught up in the design process and forget to save the drawing periodically. Most CAD systems the control of t

Other creative ideas include device scaling, which changes the sensitivity of the input devices. The new 200-step-per-inch Microsoft Mouse I used, for example, proved to be a little too critical for easy and exact positioning. The scaling feature al-

lowed me to adjust the mouse's precision perfectly. T & W includes suggestions on using VersaCAD with RAMdisks and even on networks in its excellent documentation.

OTHER LIMITATIONS In addition to the drawbacks I've already mentioned, a few more limitations counterbalance the elever lieds after appear throughout the program. One potentials managing limitations to be program to be program to be program to be program. One potential program to be program to the program to the program to program the program to program the program to more than 100 call from the program to the program t

VersuCAD is a 2-D system. An optional solid modeling module, which costs \$495, offers limited 3-D capabilities that are superior to AuneCAD's but less powerful than those offered by CADKEY. The 3-D system runs outside the normal 2-D VersaCAD, creating drawings that the main VersuCAD program can use. The biggest weakness is that you must enter every point from the keyboard with three coordinates—a cumbersome and slow process. The module forms objects by points and







VersaCAD Advanced incorporates a host of creative ideas into its design.

polygons; data for both are stored in tables.

This method is workable only when you're

dealing with relatively simple objects. The basic VersaCAD package includes no attribute system. An optional bill of materials module is available, also for \$495. This VLIST module is as good as the 3-D module is flawed. The system works with symbols previously defined and stored in libraries. You define three tables that store information about the symbols. VLIST is relational and links the various tables as needed. A "match table" includes fields for a part code, size, unit cost, unit weight, unit labor cost, labor grade, and the library and symbol designation. A "description table" adds a 40-character description field for each code number. A "labor table" includes keys to the labor grade and includes hourly wage and the type of labor involved.

You define and edit the tables with a smooth, field-oriented editor that walks you through e-verylining required with well-formatted screens and detailed accessed instructions. Once all is in readiness, VLIST creates a fourth table by counting the symbols in a designated drawing. The system can then prepare reports based on your specifications, performing sorts, cost extensions, and other calculations in the process.

The report generator system is easy to use and adequately flexible for the task at hand. The program can store report definitions for future use. T & W even provides a

BASIC program that converts a VLIST report to a format that can be read back into a drawing to allow inclusion of parts counts and the like as drawing documentation.

The VLIST system is rigid in its field structure. The structure is so well thought out, however, that it will meet the needs of a wide spectrum of VersaCAD users. It's actually quite superior to some third-party attribute management systems available for competitive CADs, and it's well worth the cost.

An IGES translator for drawing interchange with other CAD systems is also priced at \$495.

VersuCAD has come a long way since the early versions. I first saw a year low ago. Some of its subsystems don't roffer the variety of functions available in competitive programs; there's no macro language, and you can't change or customize the menus in any way, but the package does gram does one enjoy the wealth of finitparty support available for AutoCAD. Put inclined to the other CADs reviewed here. Overall, I found VersuCAD to be a competent performer with much to offer.

AUTOCAD

Autodesk Inc.'s AutoCAD holds the enviable position of dominating the microcomputer CAD market. Some 44 percent of micro-based CAD installations use Auto-CAD, which means that AutoCAD comes close to selling more than all its competitors combined. Like dBASE and a few other products, AutoCAD has become something of a de facto standard. More third-party programs and books are available by far for AutoCAD than for any other CAD program, a comfortable backdrop for anyone considering adding CAD capabilities. Autodesk admits that AutoCAD's predominant position is as much due to timing and marketing expertise as the quality of the program itself. How does Auto-CAD stack up? Does the program deserve its market share?

AutoCAD is typically sold with three stension options called ADE-1, ADE-2, and ADE-3 (for Advanced Drafting Extension). Each builds on the previous level, increasing AutoCAD's capabilities. About 90 percent of AutoCAD's buyers purchase the program with all three extensions, so PC Magazine Labs chose to include the options in this review, too.

Installing AutoCAD is straightforward. The program supports an unusually wide range of video adapters, digitizing devices, and plotters as well as a few printers



(see the accompanying CAD Hardware Capabilities table). It gives you detailed interfacing instructions and a clear and selfexplanatory menu system to install any given set of peripherals.

COMMAND ENTRY You can enter commands in several ways. An on-screen menu normally occupies a strip along the right side of the screen display; you can select any option from it with the digitizing device or cursor keys. Related commands are grouped in a hierarchical tree structure. and once you've selected a command, the program displays specific options for a given command. Every AutoCAD command is on one menu or another, but it can take you several picks before you locate the desired command. A command to return to the previous menu or to the root menu is included on every submenu. which makes moving around a bit less of a chore

You can allocate up to four areas of a digitizing tablet for tablet menus. Auto-CAD allows you to specify as many commands as can fit legibly in an area. You simply indicate to AutoCAD how many rows and columns you are defining in a given menu area and the program automatically calculates where the commands are located. Tablet menus can save a lot of arm movement on large digitizing tablets and are often much faster than searching through the on-screen menus, but they reduce the space available for screen pointing and obviously don't work with relative pointing devices like mice. If the digitizing device has multiple buttons, they can be used for command selection. The exact procedure depends on the characteristics of each device, but multibutton pucks can be used to good advantage.

Finally, command names can be typed at the keyboard. While many drafters are not typists, keyboard command entry can often be the fastest method. Since typing commands directly shortcuts the menu system, AutoCAD can be considered both menu driven and command driven.

COORDINATES AutoCAD also offers several methods for indicating coordinates. You can use the digitizing device or the cursor keys to simply point to a place

on the screen, or you can type in absolute, relative, or polar coordinates at the key-board. Although Auto-CAD can work with the cursor keys alone, it is a cumbersome method: You use the PgUp and PgDn keys to change the distance that the cursor worse. Using the cursor pad is occasionally convenient when very small movements are routired.

Various utility commands add flexibility to this process. The Limits command designates the boundaries of a drawing and

 AutoCAD's installation program gives you detailed interfacing instructions and a clear and self-explanatory menu system to install any given peripherals.

controls whether points will be allowed controls their range. Another, Units, adjusts how all coordinates and measurements are made to accommodate various drained side significant, engineering (feet and decimal numbers, engineering (feet and decimal niches, rendered as $1^{\prime}-4.5^{\prime}$) or architectural (feet and fractional inches, rendered as $7^{\prime}-65^{\prime\prime}$) can be used, and each on use decimal degrees, degree-seminates seconds, grads, or radians for angular notation.

AutoCAD includes DOS-like commands for file directories, deleting, renaming, and copying files, and a Shell command allows you to execute other DOS commands and programs from within AutoCAD.

ENTITIES AutoCAD calls the elements that comprise a drawing "entities." It offers a rich assortment of primitive entities, with many options to assist in drawing them. You use the Line command for the most basic entity. Lines can be continued

to form a series of line segments, and Auto-CAD can automatically close a series of lines to form a polygon. The Point command places a point on the drawing. Circles can be drawn by specifying the centerpoint and radius or diameter or by specifying either three points on the circle's circumference or the two endpoints of its diameter. The Arc command offers eight ontions, including specifying three points on the arc, a continuation of a previous arc (useful for creating french curves), and various combinations of start point, centerpoint, endpoints, included angle, length of chord, radius, and so forth. The Trace command forms lines of a specified width, while Solid forms solid objects. You can also sketch freehand; AutoCAD has a set of commands to control the line increment used, raising and lowering the sketching "pen," and more.

The ÅDĒ-3 package includes an entity called "polyline." A polyline is a connected sequence of lines and arcs, which can be wide or tapered and can be formed of dots and dashes as well as the normal continuous line. Various complex manipulations can be performed on polylines with impressive results. Both polylines and traces are displayed in their wide form on the screen.

Polylines merit a complete AutoCAD subsystem for editing. Polyline width, opening or closing of a polyline polygon, removing kinks and curves, breaking or joining polylines, curve fitting, and more are available.

TEXT COMMANDS AutoCAD includes equally impressive commands for text. Text can be any size; justified left, right, or center: rotated at any angle; and aligned between two points (in which case Auto-CAD automatically sizes the text to fit perfectly). The program offers five type fonts, including a standard plotter font, a Simplex rounded sans-serif font, a complex multistroke font, and an italic complex font. A vertical font, which draws letters one above another, is also included. Auto-CAD's Style command allows you to stretch these fonts vertically and/or horizontally, slanting the font to either side, printing letters upside down or backwards. and so forth.



When editing entities in Auto-CAD, you can select a group of one or more entities you want to manipulate. The concept is similar to that entipleyed in some word processors. In Microsoft Word, for instance, you can choose a group of characters by dragging a mouse. In Auto-CAD, you can thoose a group of characters by dragging a mouse. In Auto-CAD, you can thoo as the program indicates that it has found the object with both a text message and by highlighting the object in some way, depending on the video system in use). You can directly choose the last entity you

■ In AutoCAD, you can directly choose the last entity you drew, a handy feature for making immediate corrections

drew, a handy feature for making immediate corrections. Multiple objects can be chosen by continuing to point them out one at a time or by drawing a window around them.

Once a selection has been made, the Erase command can remove them, and an Oops command reverses such an erasure if needed. The Move command moves the selected objects from their current location to a new location. Copy creates an identical copy at a user-specified position; Mirror creates mirror images, either retaining or deleting the original objects; Fillet joins two lines with a smooth arc or right angle; Chamfer trims two intersecting lines a specified distance from the intersection; Break erases part of a line, trace, circle, or arc or splits these entities in two: and Array creates either circular or rectangular arrays of existing entities with user-specified

A powerful Change command can modify several characteristics of existing entities. The program allows you to specify a "change point" and move line endpoints to it. A circle's radius can be made to pass through it, text can be moved to

GENERIC CADD

Centric CADD is tiding on the crust of a couple of trends. One, the acceptance of low-cost generic products like those that first appeared in pharmacies, is the source of the program's name. Decision considerate enough to prescribe and expensive trademarked products and expensive trademarked products are their patients a bundle. Supermiskets now offer generic foodsuffs priced below even their own house brainds. Packaging is simple, but quality is good middle blower.

CAD is a bot item in microcomputer software. When Generic Software Inc. of Bellevue, Washington, announced Generic CADD for only \$99.95, 1 could see the analogy to generic brands. The packaging is fittingly simple, and the laser-printed manual, while excellently written, does not contain a single picture. An according to the contains of the contains of the contains are also picture, and the contains a single picture. In the contains a single picture at \$29.91 was really doubtful that such an inexpensive program could really even merit the classification of CAD, much less be any good.

Generic CADD arrived too late for a full evaluation, but my first pass through the program shows it to be shockingly good for the money.

The program supports a fine selection of video cards, plotters, digitizers, and

mice and recognizes an 8087 or 80287 math coprocessor chip if one is present. You install the program using an excellent menu system. I initially had trouble using a Logitech mouse and a GTOO Digi-Pad digitizer, but Generic's unusually helpful support staff was able to resolve the problem.

soive the proteem.

Generic CADD's interface uses an on-screen menu displayed along the right side of the screen. Four sequential, rather than hierarchical, menus are available. The program offers three alternative tablet menus with different layouts and sizes. The program also allows you to bypass the menu by accepting a series of two-characte keyboard commands.

The assortment of entity drawing, editing, and other commands is reasonably comprehensive, especially for such a low-cost program. Many significant features offered by high-end CAD programs are missing, including fillet and chamfer, mirroring, attributes, pan, orthogonal mode, on-line help, area fill (even during plotting), drug, cross-hatching, and so on.

But the capabilities that Generic CADD does have are well executed. The "feel" of the program is very much like those of the major-league CAD systems. Generic positions its program against the price. While it is difficult to come to a firm conclusion based on a preliminary examination, my first reaction is that Generic CADD offers a much more professional interface has ProDesign II, as well as good performance, and hat be the proposition of the proposition of the proting of the proposition of the proposition of the proposition of the proposition of the proting of the proposition of the pro-

I was surprised at what ProDesign II can do at its price level; I am even more impressed with Generic CADD. Like generic medicines, it offers a tremendous price/performance ratio. Unlike a real generic, the performance instite a real generic, the performance instite a real sense, the same as that of a well-known brand name, but Generic CADD clearly offers a lot for the buck.—Gleen Hard.



teaching simutions

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start at it (and the text style, size, rotation, and actual text revised in the process), and so on. The layer (discussed later) on which an object resides can also be changed.

AutoCAD can calculate distances, the lengths of perimeters and the areas of closed polygons, exact screen coordinates, and angles. Various inquiry commands and status reports can be used to determine these statistics and more. None of the cultural cultural constance of the control of the distance of the control of the distance of the control of the distance dist

AutoCAD has several commands to control how a drawing is displayed. The most important is Zoom, which, like a telephotoles on a camera, moves the eisible image "closer" or "further away." As with a lens, when the magnification of entiry is increased, a smaller portion of the drawing is visible, but in greater detail. Zooming is especially important with the drawing is visible, but in greater detail. Zooming is especially important with the consequence of the proportion of the necessary to zoom in to work on small entities with adocument detail.

The Zoom command includes several options. You can specify the zoom with a numeric factor like 2X; you can draw a window and the area within it will then fill the screen; or you can use various other options to select the area of interest. The Pan command allows you to view a different portion of a drawing without changing the current magnification ratio. A portion of a drawing can be given a "view" name (conceptually similar to a named range in 1-2-3); it is then especially easy to return to that area. Dragmode, an ADE-2 option, controls whether objects can be dragged around on the screen for visual positioning, and several other related commands control how AutoCAD redraws and manipulates the screen image.

LAYERS AutoCAD layers can be thought of as transparent overlays on which images are drawn and which are positioned one on top of another in perfect registration. It is often convenient to group related entities on separate layers, especially since each layer can be displayed in a different color on the screen (subject, of

course, to the limitations of the video system). When drawings are plotted, layers can be assigned to different pens and colors. AutoCAD allows an unlimited number of layers, each of which can be given a name; it is much easier to refer to the "Plumbing" layer than to "Layer 21." Each layer can be turned on or off, and the current layer can be changed readily. All drawing takes place on the current layer. Lavers can also be assigned different line types, either ones you define or the ones supplied with the program. Each layer can hold only one color and one line type, a restriction that most other CAD programs do not impose.

One of the primary virtues of any CAD system is that it lets you draw quickly and somewhat sloppily while obtaining perfectly accurate results. The AutoCAD program includes very powerful drawing aids that assist you in this way. Some are simple visual aids while others affect how entities are located.

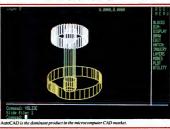
The Stap function locks points into alignment with an imaginary grid that can be spaced at any interval. The snap spacing can be different in the x and y dimensions, and the snap grid can even be rotated. When the Snap mode is enabled, the cursor can not be positioned anywhere other than at an intersection of the imaginary

 AutoCAD lets you draw quickly and somewhat sloppily while obtaining perfectly accurate results

snap grid, which makes it easy to create perfect intersections and perfectly even spacing.

The Grid command displays a reference grid of dots on the display. This grid is not related in any way to the snap points, and it is often useful to display a grid that is less dense than the snap settings.

Object snap is one of AusoCAD's most powerful tools. You use object snap to position a new point in relation to already exting objects. Using object snap assures that the junctions between objects are perfect, and it also performs calculations that allow perfect tangents to circles, absolutingly accurate perpendicular lines, and various other such intersections. Some of the object snap modes available include Near-





est, Endpoint, Midpoint, Center (snap to the center of a circle or arc), Node (snap to a point), Quadrant (snap to the 0, 90, 180, and 270 degree points on a circle or arc), Intersection, Perpendicular, Tangent, and so forth.

When object snap is in effect, the normal crosshair cursor is changed to include a "target" area, widening the cursor's size. This cursor allows a less accurate point; the object to be snapped to has to fall only within the target area. The size of the target can be adjusted for your preference.

urget can be aujusted for your preserence.
You can use the object snap facilities without invoking the object snap mode system. Simply typing the first three letters of any of the modes while drawing an entity invokes the specified object snap for only the next operation. Once learned, this is a terrific tool for drawing even faster than normal without sacrificine accuracy.

Other drawing aids include Ortho, which allows only vertical and horizontal (orthogonal) lines; Isoplane, which selects the left, right, or top plane in isometric drawings; and Axis, which displays gradu-

 AutoCAD's Script system lets you assign a complex sequence of commands to a menu entry or create continuous demonstrations.

ated axes along the edges of the drawing

area. Many drafting environments use the same symbols over and over again. Rather than draw complex objects each time they are needed, you can use AutoCAD's two mechanisms that store complex sets of entities for fast recall and reuse. Blocks and be defined and reused within the current drawing or written out to disk for use with other drawings. The Insert command places the block into a drawing at a point out specify. Both the 2 and vintensions.



AutoCAD supports a wide variety of digitaters and display adapters.

can be scaled to size the inserted object, and the object can be rotated around its insertion point as well (visually if Drag is available and enabled). AutoCAD also has a Shape system that, so far as you're concerned, works similarly. These shapes are much more complex to define but are somewhat faster and more efficient to use.

AutoCAD's ADE-1 option includes a comprehensive dimensioning system. You can do linear, angular, diameter, and radius dimensioning and specify various styles. For example, dimension text can include tolerances in plus/minus form or as high and low values. You can draw leader lines or a center mark, or add center lines to circles. The dimensions can be horizontal, vertical, aligned to a slanted object, or rotated by a fixed angle. Baseline dimensions (several dimensions emanating from one extension line) or Continue dimensions (measurements that continue along an object, effectively segmenting an object into shorter measurements) are available.

SOPHISTICATED HATCHING Auto-

CAD has a sophisticated hatching system to add patterns to closed objects. Forty-one predefined patterns are included, most of which are architectural in nature, or you can define your own temporary or permanent patterns. Hatching can fill an entire specified area, regardless of internal contents, or AutoCAD can hatch alternate internal objects for improved visual differentiation.

A Script system allows you to execute a series of commands automatically; you can assign a complex sequence of commands to a single menu entry or create continuous demonstrations. A drawing can be made into a "Slide" and subsequently displayed very quickly; a series of such slides can be ordered into a show for clients. The ADE-3 package includes a system to define integer, real, point, and string variables. You can use these variables whenever appropriate and perform arithmetic and conditional operations on them. This is the foundation for the embedded LISP high-level language that Autodesk will be releasing soon.

access with the receiving soon." Yet another major AutoCAD system is Antibotes. An attribute is a text entity that is used to label a block or other entity. Sometimes called "tags" in other systems, attributes a user-defined frelessating information about the object. As which can be displayed with the object or stored invisibly. When you select the object, and the object or stored invisibly. When you select the object of stored in you are prompted to enter the data for each field. The stored information in the object of stored i

Using Lotus 1-2-3° without Reflex is like driving at night without lights

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CAD SOFTWARE

eral forms. You can use external high-level languages like BASIC, Pascal, and so forth, database management programs like dBASE III or dBASE III, or integrated programs like Symphony to manipulate this data and create summary or bill of materials reports.

A BID TO BECOME THREE-DIMEN-SIONAL AutoCAD has always been a two-di-mensional CAD system, but Autodesk has begun to add the foundations to transform it into a three-dimensional system. An Elev command sets an elevation and thickness for subsequent objects drawn. Vpoint allows you to change the view of a drawing that has thickness. A fascinating "compass" representing a flat globe and an "axes tripod" can be used to rotate the x, v, and z axes, AutoCAD uses a wire-frame method of displaying 3-D objects: the Hide command removes hidden lines. The 3-D system as presently implemented is fun to experiment with, but its limitations are severe compared to true 3-D CAD systems like CADKEY. Autodesk

intends to improve this area's functionality in the future.

AutoCAD's plotting facilities are extensive; it can produce output on both plotters and dot matrix or laser printers. You select the area to be plotted in several ways. Each

layer of the drawing can have a different pen assigned to it (the program automatically prompts for pen changes if more pens are specified than the plotter in use can store at one time), and each pen's speed can be adjusted. You can assign different line types to a layer as well. (The plotter hardware generates these line types, as distinct from the line types that you can draw directly into the drawing.) The plot origin can be specified, an occasionally useful feature for drawing several small plots on a large piece of media or positioning the plot in the middle of a sheet. You choose plot size with either the standard letter designations like A and B or input the exact dimensions. You can rotate 2-D plots 90 degrees if desired. If you input the pen width you are using, that figure controls the rate of solid area fill: the thinner the pen tip, the more passes AutoCAD must make for a well-filled solid.

Most importantly, the scale of the drawing can be controlled by indicating can be controlled by indicating the relationship between plotter distance and drawing units. For example, a distance of 1 inch on the final plot can represent 400 feet, I mile, I inch, vo whatever scale units. Alternatively, you can instruct Auto-CAD to fit the drawing onto the plot at discretion, which results in attractive plots

AutoCAD's plotting facilities are extensive: it can produce output on both plotters and dot matrix or laser printers.

The newest release of AutoCAD includes plotter optimization routines that can cut plotting time by over 50 percent. This feature by itself is sufficient justification for owners of earlier releases to upgrade (see the review of the CalComp 1043GT Plotter for an example of the time savines nossible).

AutoCAD can be customized in several the screen and use them on all drawings (the normal screen menu is simply such a definition) or attach them to a given drawing. Special line types can be defined for those drafting disciplines where dot and dash patterns have significance. You also also define custom text fonts. Fonts are sequences of strokes, not dot matrix patterns. You can write custom help texts as

well.

Drawing data is stored in Auto-CAD Formats that are not normally accessible to or usable by other programs. Auto-CAD includes utilities to convert existing drawings to a format that other CAD programs can use (interfaces to various minicomputer and mainframe CAD systems alterady control of the commentary of the comme

A wide variety of CAD workers in many different disciplines use AutoCAD. It is a compliment to its Retivility that it works as a general-purpose CAD program for such disparate markets. Autodesk's open architecture philosophy allows people to customize the program to meet personal preferences.



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So you move your cursor to "A" which is the right 'right," but Return and the spelling mustake is instantly fixed. And the program you were working on has continued Lightning (if you director our remember was Spelling grades in school, the create that when not found writing the enter page, any spelling monakes well be Lightning nover goes away, is 100% concurrent, reliable

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SOFTWARE

CONCLUSION Surely there are many features that AutoCAD does not include. After using other CAD programs, it's ob-vious that such features as parallel lines, organized symbol libraries, multipoint splines, filleting and chamfering of curves as well as straight lines, and many other

■ It is a compliment to AutoCAD's flexibility that it works as a general-purpose CAD program for such disparate markets.

capabilisies are distinct ornisiones. Many such features can be added to the program such features can be added to the program specially with the ADE-3 variables and expressions capabilities, but his process is both slower and more difficult than using built-in functions. Auto-CAD doesn't use to good advantage the color capabilities to good advantage the color capabilities program is also rather difficult to learn, although any program with this many features will have a reasonably steep learning able; it's detailed but has no tutorial and far too few examples.

All in all, however, AutoCAD is among that class of rare programs that transcend their limitations. Once learned, AutoCAD feels comfortable and powerful, capable and even friendly. While its initial difficulty perhaps makes it an inappropriate CAD program for rank beginners, AutoCAD users quickly find themselves turning out accurate and attractive design work with much less effort than manual drawing. Competitive CAD programs all have a set of features they can point to that AutoCAD doesn't have, but AutoCAD offers a combination of features that obviously works for a tremendous number of users. It is an excellent package that can be recommended to a wide variety of CAD disciplines.

IN*A*VISION

In a Vision is a new graphics program from Microgark, the developers of the popular PC-Draw drawing package. PC-Draw is something of a hybrid that combines some of the features of a free-form painting program with a symbol-management feature and special tools that make it useful for structured drawings like organization charts, office plans, and the like.

In*a*Vision shares some of PC-Draw's schizophrenic nature. Even Micrografx's ad scall it a "drawing/CAD" program. Is this dual positioning merely an attempt to cover two markets, or does In-*a*Vision indeed offer the best of both worlds for its low price?

WINDOWS-LIKE INTERFACE Ina*Vision is one of the first programs developed to be compatible with the Microsoft Windows operating environment. This compatibility with Windows benefits both the developer and the user several ways. Micrografx was able to employ the windowing, pull-down menus, scroll bars, and other Macintosh-like features designed into Windows. The program also can use the hardware drivers provided with Windows, greatly easing Micrografx's task of interfacing with video displays, printers, and plotters. The user benefits from this added flexibility, for as Windows supports new devices, In*a*Vision automatically supports them as well.



In Short: One of the first programs to be compatible with Microsoft Windows, but it's perhaps more an advanced drawing program than a true CAD package.

CROLE 475 ON PEADER SERVICE CARD You do not need to have Windows itself to run In*a*Vision. When you buy In*a*Vision was on receive what is, in essence, a run-time version of Windows. The program doesn't offer the benefits of concurrency (simultaneous operation of more than one program) that Windows includes, but otherwise In*a*Vision works very much the same way whether Windows is present or not.

MACINTOSH INFLUENCE The InarVavian uses interface is storagly influenced, to say the least, by the Macintosh. The program uses many of the Mac's features, including the row of pull-down menus at the top of the screen, scroll bus to move the image within the window, dynamic window sizing, dialog boxes with select buttors for error messages and parameter settings, directory boxes for choosine files, and so forth.

Some changes have been made. What looks like a normal Macintosh "close box," for example, actually displays a pull-down menu for moving a window, zooming the window so if fills the entire screen, converting the window to an icon (which keeps the drawing active but removes it from the main screen), and so on.

stocks utilities that execution, also mouse and the A two-button mouse is sufficient, the program uses the first button for normal operations, and you, can define the program function to be assigned to the second button. Windows uses a utiling scheme for windows butt up against one another rather of the second button to be assigned to the second button windows butt up against one another rather of the second button to be a second to the second button to be a second to the s

This interface style is now used by many free-form painting programs on the PC, such as PC Paintbrush, PC Paint, and the like. The first impression you get of In-*a*Vision is that it, too, is a painting program, but this is really not the case.

DRAWING COMMANDS In*a*Vision includes a good selection of drawing commands. The usual In*a*Vision drawing cursor is a pencil accompanied by a minia-

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Traveling SideKick is the organizer for the Computer Age!

Traveling Sidelick is both a hinder you take with you when you travel - and a software program - which includes a Report Generator — that generates and prints out all the information you'll need to take with you. Information like your phone list, your client list, your address book, your calendar, and your appointments. (The Appointment Schedule or Calendar you're already using in your SideKick is automatically used by your Traveline SideNeck. You don't waste time

and effort re-entering information that's already there.) One keystroke generates and prints out a form like your Address Book. (You don't need to change printer paper.) You simply use a standard 3-hole punch which you can steal from someone else's desk — punch out the holes, fold and clip the form into your Traveline SideRick bander - and you're on your way. Because Traveling SideNick's hinder and software are CAD (Computer Age Designed), you don't fool around with

low-tech tools like sessors, tape, or staples. Just one keystroke, 3 holes and you're on your





CIRCLE 139 ON READER SERVICE CARD

You don't have a SideKick? You must be kidding.

More than half a million people already use Borland's desk top organizer, SideKick (Winner of InfeWorld's "Product of the Year" award, it is also the #1 best-seller for the IBM PC**) Anyway, if you don't have one already you need one now and we'll give you a special price break Bay Traveline SideKick and SideKick for only \$125.00 (Sold separately they add up to \$154.90, so you save \$29.90-which we hope you don't have to spend on cabs which take you the long way to the airrort)

What the software program and its Report Generator do lor you belore you go - and when you get back.

Beiore you go:

- · Prints out your Caleodar, Appointments, Addresses. Phone Directory, and whatever other information you need from your data files.
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engagements

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100 1985 Bonard International Bi-10274



ture icon that indicates what the program is set to draw. A tiny circle, arc, or line is a good reminder of what will be done next.

The program can draw lines in several widths and styles, with a choice of continuous or dot-dash patterns. Drawing continuous in the say aparted option from single lines, and a horizontal vertical line option che and are commands, and most of the others as well, use rubberbanding to form the image. This method is generally fine, but it's limiting compared to the precise method and the commended and the co

Other available drawing entities include rectangles, ellipses, polygons, squares, and rounded rectangles. The package offers no filleting capability, but at least the rounded rectangle is provided for that specific shape. An unusual piedrawing entity is a multistage operation that creates solid or exploded pies. When you select the Pie option, a counterclockwise movement draws the first slice, and subsequent picks define each slice around the pie. This feature is quite clever, but I'm not sure of the purpose of a pie chart in a CAD system. Surely, Micrografx doesn't intend In*a*Vision to be used as a presentation graphics program?

In ${}^{*a}v^{*i} Vision^{*}$ s area-fill mechanism takes getting used. The usual method for filling areas in drawing and CAD programs is to define the entity and then fill it in. In ${}^{*a}v^{*i} Vision$ can work the same way for lilling closed objects, but normally it links the definition of an entity with the filling closed objects, but normally it in ${}^{*a}v^{*i} Vision$ when you select a solid color or one filling closed objects, a bottle one of the many predefined patterns, ${}^{*a}v^{*i} Vision$ fills a bounded area immediately as it is created. The fill function works retroactively on a closed object, too.

HANDLING TEXT In*a*Vision's text provisions are flexible and impressive. The program offers two types of text: graphics and standard. It gives you three graphics fonts and five standard fonts, and you can use any fonts that work with Microsoft Windows as well.

The package can stretch, rotate, and otherwise manipulate graphics text, as it

does other graphics entities. In*a*Vision draws standard text—which looks better than graphics text—faster than it does graphics text, but it can't manipulate standard text the way it does graphics text. Unlike in many CAD programs, reasonably flexible editing is possible, and you can

■ In*a*Vision is one of the first programs developed to be compatible with the Microsoft Windows operating environment.

apply boldface, underlined, strikethrough, and italic attributes to any text.

As with many Macintosh programs, some keyboard control characters are equivalent to menu selections. Some of the choices are odd, though. For example, the program gives you a keyboard equivalent for drawing an ellipse, but none for drawing a circle.

EDITING In*a*Vision*s editing commands allow you reasonably flexible control for modifying existing objects. You can select entities individually or through windows, but manipulating multiple single entities that don't conveniently fall into a "windowable" area is a bit awkward. However, you can use the second mouse button when selecting objects to reposition the starting point of a window.

The program can combine groups of entities and then treat them as one entity, much like a block. The Break Apart command is the reverse of the Combine command. The program allows you to nest oblects ombined into subassemblies into other such assemblies up to 256 levels deep, so you can build complex items from simpler building blocks.

In*a*Vision can copy entities either with a menu command or when you hold down the Shift key and drag—a fast and

flexible method. Horizontal and vertical Mirror commands don't create new mirror images but simply flip the selected entity. This feature is useful, but the command entity should be conditioned to the command and the command of the command of the command of the commands are all mirror image, and the manual as a real mirror image, and the manual condition of the commands work in a similar feshion. Since these commands and others use further commands work in a similar feshion is flex to the commands and others use further commands for the function they are.

Top and Bottom commands illustrate another interesting concept. They change the layering of objects that are positioned on top of one another. (Note that this layering has nothing to do with layers in the overlay sense.)

Int a Vision uses an interesting paging scheme to manage larger-than-normal drawings. The various View commands and sipaly objects actual size or show the pages that have been used, all pages, and other options. It gives you a sort of a structured zoom over a large number of sheets. You can set the pages to the standard A through E sizes or specify customized dimensions.

In*a*Vision has a normal Zoom command as well. Selection is only through windows—a somewhat limited method. The Zoom views can be nested as deep as 16 levels. Scroll bars accomplish panning, an excellent system.

Int a Vision uses an odd coordinate system that places the origin in the upperleft corner. You can use up to 32K of steps, which translates to a step resolution of 0.002 inch. The program can display the coordinates of the cursor position immediately adjacent to the cursor, which is something of a mixed belssting. It is convenient not to have to look selewhere on the them can be difficult or impossible if they happen to be positioned over filled area or text.

Instead of the usual pointer, you can select a crosshair-type cursor with a horizontal and a vertical line extending to the edges of the screen. This cursor is more like the types most other CAD systems use, but the informative icons that indicate the drawing option aren't displayed when you use it.

DIMENSIONING A rather primitive dimensioning provision displays the dimensions of a rectangular "bounding box" surrounding an entity; this method works fine for some types of objects, and is useless for others. Currently In+a+Vision has no mechanism for including dimensions in the drawings.

When you select an object, six little solid-block "handles" appear around it. Placing the cursor on one of these allows you to move or stretch the object, either proportionally or distorted. This interactive, flexible method is similar to that of MacPaint.

In*a*Vision uses a ruler system to control the on-screen grid and snap. The rulers can be modified easily to adjust spacing increments. The Align to Ruler command moves entities to snap points even after they've been drawn, but there is no provision to align the grid with an existing point.

The program can access 16 overlays or layers. You can set layers to accept only one color or multiple colors. Other commands import and export drawing information to "multiple instances of In*a*Vision" or "compatible applications running under Microsoft Windows." The manual is rather vague about this feature, perhaps because no other Windows-compatible candidates exist as vet. In the meantime. you can import text produced with Word-Star or other word processing programs to an In*a*Vision drawing.

When you produce hard copy on plotters, dot matrix printers, or laser printers, the program takes advantage of the Windows print-spooling mechanism-a real timesaver for long, slow plots. The printer specification system is interactive, easy, and flexible. In a Vision can print a range of pages or a selected portion of a drawing.

EXCELLENT TEMPLATE SYS-TEM PC-Draw's template system displayed a selection of previously defined symbols and allowed easy selection and inclusion of symbols into a drawing. In-*a*Vision greatly expands on this concept with an excellent template mechanism. Libraries of symbols can be displayed in separate on-screen windows. Incorporating one of the symbols is as easy as a mouse

ROBOCAD-PC

The CAD programs reviewed in this series have a variety of user interfaces. Some are almost totally keyboard oriented, with commands issued by striking letter keys, while others look to the system's digitizer or mouse for instructions. Most use some form of hierarchical tree menu structure. One. In+a+Vision, uses a pull-down menu system inspired by the Macintosh and its Xerox

RoboCAD-PC, a new CAD program soon to be released by Robo Systems Corp., takes the Macintosh-style interface a step further. It makes use of all the traditional Mac features like pop-up windows, pull-down menus, dialog boxes, and the like, but it combines an elegant and intuitive user interface with serious CAD functionality.

PC Magazine Labs examined a prere-



lease version of RoboCAD, but most of the advanced functions were already in place. Icons are used almost everywhere. The program is slick and impressive and meets its designer's goals of a CAD system with a much shorter learning curve than those of its difficult-to-learn competitors. Unlike many other CAD systems, RoboCAD strives to let you keep your eyes on the screen and resorts to the keyboard only rarely.

It incorporates several unique features, which include "magnetic points" used for its always-present object snap function, polar grids that have a series of radials from any chosen center with selectable angular spacing and snap-point separation, and a graphic catalog of drawings. The standard CAD functions look good as well; RoboCAD has an excellent dimensioning system and handles filleting of arcs and circles as well as of straight lines. It can exchange drawings with AutoCAD via a DXF module. Images are stored in two forms: vector for database and plotting, and bit-mapped raster for fast screen updates.

RoboCAD is a descendent of an Apple CAD system developed in Europe that has gained a dominant position in the Apple market. For a first entry into the serious IBM PC CAD market, RoboCAD clearly benefits from this background. It is an exciting, full-function product that PC Magazine hopes to examine in depth

in a future issue. - Glenn Hart

click for selection and a drag into position. This system is much better than the usual CAD system of typing the name of an unseen symbol to insert it. You can define a symbol ID and then store it with the drawing. Also, Micrografx obviously plans to incorporate data extractions in future releases for bill of materials and other attribute use

I enjoyed testing In+a+Vision. The program is fast, and on my 8-MHz AT, In-*a*Vision was extremely quick. In contrast to the screen operations of many IBM drawing programs, In*a*Vision's are at least as fast as the Macintosh's. I was able to create drawings quickly and with little learning effort. Output on both a Laserjet and an HP plotter was accurate, and the spooling mechanism, as I mentioned above, is a real timesaver.

Of course, compared with the true CAD programs reviewed here, In*a*Vision lacks many drawing and editing facilities. If you're used to AutoCAD or its competitors, you'll sorely miss the commands

(continues on page 144)

Once I had a byte

that became errant and wild, and started destroying all of my files. It lost all my data, spoiled the show; there was no doubt about it, some chip had to go.

denotes IBM-AT compatibility.	
SOFTWARE	PC Connection Software Special PC Connection Software Special PC Connection Special PC C
We only carry the latest versions of products. Version numbers in our eds are current et	through April 15, 15
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-Superkey/Sidekick Package (includes \$15 rebate coupon from Borland) 67. -Turbo Pascal 3.0 37. -Turbo Pascal 3.0 wrBCD 59. -Turbo 8087 3.0 59.	BPI Accounting Software General Ledger C.13 Accounts Payable C.13 Accounts Receivable C.13 Business Builder (Gl., AR, AR, AR)
-Turbo 8087 3.0 w/BCD. 72Turbo Holiday Pak (Pascal 3.0, Tutor, and Dalabase Toolbox). 67Turbo Holiday Jumbo Pak (Pascal 3.0,	information management, spri business graphics and word p Breakthrough Timeline 2.0.
Database, Editor & Graphics Toolboxes,	Broderbund

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	Print Shop
PC Connection	Connecticut Software
Software Special	Sideline 5.0
through April 15, 1986	Printer Boss 5.0
	Dac Software
T PROGRAMS	Dac Easy Accounting 4
/Tax Cut	Dag Easy Accounting
ax preparation program as well as a	Dac Easy Word
ax planning program	
Takes you step by step through the	Decision Resources
preparation and printing of the 1040	-Chart-Master 6.1
one form & other commonly used	Diegram-Master 5.0 20
orms and schedules	-Sign-Master 5.1
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inancial decisions on your taxes be-	GEM Desktop 1.2
	GEM Draw 1.2 (includes Desktop) 9
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On-screen menus and prompts en-	Paint and Write) 11
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Data can be transferred into Tax Cut	Market Manager +
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5-day money-back guarantee	-Membership Kit
Calculations guaranteed by Best Pro-	Enertronics
grams	Energraphics 1.3
\$119.	Evergreen
Professional Finance Program	-Accounts Payable 1.01
PFP II)	-Accounts Receivable 1.01
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Professional financial management	One Write Plus 1.0
system for your home or business	Financial Software
Capable of generating budget fore-	Financier II 2.1
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nts Payable C.13	-Volkswriter 3
nts Receivable C.13	Volkswriter Scientific 1.0 28
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ss graphics and word processing) 399.	ThinkTank 2.0
through	-Ready 1.0
ne 2.0	Micro Education (MECA)

For the IBM-PC (XT & AT) Exclusively.



The culprit was tricky

and hid from my probes,

the only clue I could find was a bizarre error code. FB255Z flashed on the screen. Now, what in the world could that possibly mean?

		TRAINING
Micropro Easy 1.0. \$97.	Simon & Schuster	
	-Wabstar's New World Speller 1.2 \$39.	ATI ⇒SKILL BUILDER PROGRAMS
WordStar 3.31	Softstyle Printworks 1.05	Intro and How To Use:
Hard disk recommended for Wordstar		Word Processing MS-DOS
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Clout 2.0 135.	assors, tile mgt., databasa mgt., spraiao- sheets, graphics, integrated accting., project	→TRAINING POWER PROGRAMS
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Multi-user) 419	-Enable 1.1. call	Wordperfect Symphony Displaywrita 3
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Microsoft Chart 2.0 197	PFS File B 01 84	-The Instructor II
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The following Microsoft mice now	PFS Plan A 01 84	-Tutorial Set (both items abova)
come with PC Paintbrush 3.0 softwara:	PFS:Writa C:00 (wiPFS:Proof) 84	Professor Pixel
-Microsoft Bus Mouse with software 5.0 135	First Succass (Combo Pack includes PFS:	→Typing Instructor
"Microsoft Serial Mouse with software 5.0 135	White. Plan. File & spelling checker) 229.	Training for Lotus 1-2-3
LANGUAGES	Sorcim/IUS	Training for dBase III
-Quick Basic 1.0 69.	-SuperCalc 3 2.1 (w/Sideways) 199.	-Training for Project Management 49.
Pascal Compiler 3.31	Spectrum Holobyte	Scarborough Systems MasterType
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-Basic Compiler 5.36	Springboard -Newsroom 35	
C Compiler 3.0. 235.	Clip Art Volume 1 (for Newsroom) 19.	
Business Basic Compiler 1.10	Unison	EDUCATIONAL
Microstuf	Art Gallery 1	Barron's
rinfoscope 1.03	Printmaster 1.1	Computer SAT
Crosstalk XVI 3.6	United Software	Designware
→Remota 1.3	Einstainwriter 7.2 (wicoupon for free	Spellicopter (ages 6 to adult)
→Transporter 1.4 (includes Crosstalk) 169.	Speller)	Mission Algebra (ages 13 to adult) 27.
MultiMate International	In-House Accountant 2.05	European Nations (ages 9 to adult) 27.
Just Writa 1.0 79.	ASCII Pro 4.23	Grammar Examiner (ages 9 to adult) 27.
-MultiMata 3.31 call	Xanaro	States and Traits (ages 9 to adult) 27.
Multimata Advantage 3.6 call	-Ability 1.0A call	Digital Research
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-Clipper 349.	V	OwlCat SAT (15 hours)
Peter Norton	You can now call us	OwlCat SAT (60 hours)
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For the IBM-PC (XT & AT) Exclusively.



What good were the manuals?

They were written for techies, not for people like me, a confused high execy. I called up the people who'd sold me the thing, but they didn't even answer, just let the phone ring.

Spinneker		Infocom Difficulty levels shown in Italics
All Spinnaker products now work with DOS 2.x and 3.x. Educational Games for Young Computer	PC Connection Hardware Special through March 31, 1986	JUNIOR Seastalker STANDARD
Users. (All require graphics board)	anadgii iliara i dii, rada	Enchanter the Witness Planetfall
Face Maker (ages 3 to 8) \$18.	MOUSE SYSTEMS	Cutthroat Wishbringer Zork I
Kids on Keys (ages 3 to 9)	PC Mouse with Ready and PC Paint	-Hitchhiker's Guida eac
Fraction Fever (ages 7 to adult)	Plus	ADVANCED
→Kinder Comp (ages 3 to 8)	-Mouse Systems PC Mouse	"Zork II "Zork III "Infidel
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Snooper Troops I (ages 10 to adult) 23.		Deadlina Starcross Suspende
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In Search of the Most Amazing Thing	Inc.	
(ages 10 to adult)	 RAM Resident outline processor 	Invisiclues (hint booklats) are available
President's Choice (ages 4 to adult)	perfect for organizing your thoughts, appointment calendars.	for most infocom games. Specify game.
Soringboard	to-do lists and phone lists	Microleague Sports
Fraction Factory (ages 8 to 14)	Instantly accessible from your favo-	Microleague Baseball (you are the man
Make A Match Math (eges 21/2 to 6) 19.	rita word processor, spreadsheet	Microprose
Piece of Cake Math (ages 7 to 13) 22.	and even PC Paint Plus	⊬F-15 Strike Eagle
Early Games for Young Children	Mouse enhances outline process-	Microsoft
(ages 21/2 to 6)	ing and allows for faster and more	Flight Simulator 2.12 (now works with
Music Maestro (ages 4 to 10)	facile operation	Harcules Mono Card)
Easy As ABC (ages 3 to 6)	Record detailed notes quickly	Six scenery (airport) disks are available
Stone (requires graphics board)	 Collect commonly used information 	Flight Simulator (also work on Sublogic Je
Across the U.S.A. (ages 5 and up) 22.	and automatically transfer it into any	
My Letters, Numbers, Words (ages 1 to 5) 29.	program	1Step Software
-Kids Stuff (ages 3 to 8)	PC Paint Plus	Golf's Best (Pinehurst or St. Andrew's)
-Memory Mastar (ages 3 to 8)	Draw, Paint and Edit full page pic-	Origin Systems
The Learning Company	tures in color	-Ultima III
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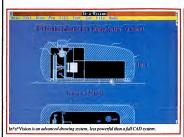
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IP€-CONNECTION





Nearly all drawing programs can create CAD-type images, but In*a*Vision makes the process easier than a traditional painting program does.

it lacks. Nearly all drawing programs can create CAD-type images with enough effort, but In*a*Vision makes the process easier than a traditional painting program does. The program is more akin to Macintosh's MacDraw than to its MacPaint soft-

"ling at the same kinds of drawings so well, In*a*Vision may am of choice for creating flowcharts (it gives with all the standard of the stand

In *a*Vision* is also much easier to learn han full-bore CAD programs. The advanced Windows user interface is far suprior in some ways to most CAD programs interfaces, and the Windows compatibility will become increasingly important if that operating environment catches on with software developers. But is In*a*Vision a true CAD pack-

age? The answer depends to a large degree on your definition. In*a*Vision is not as adept at free-form sketching as an artistic program. It's much more structured, however, and so creating exact drawings is far easier.

Micrografx positions In+a+Vision as an entry-level CAD system appealing to a different segment of the market than does AutoCAD. Although it's certainly less powerful than a full CAD program, In*a*Vision may be more than adequate for many users. Micrografx may even release a conversion program to move In*a*Vision drawings up to AutoCAD (and from there they could be ported to mini and mainframe computers as well). In any case, In-*a*Vision offers a unique interface, reasonable drawing power, compatibility with Windows, and shorter learning time-all at much lower cost than most other CAD programs. It is also fast, accurate, and fun to use.

CADVANCE

CalComp is a Fortune \$50 company with an enviable reputation for manufacturing high-quality plotters, especially in the high-end Esize plotter market. Its new 1043 plotter, with its excellent performance at a price point below similar competitive devices, is now increasing the company's share and visibility in the mi-crocomputer CAD market (see the accompanying review of the 1043 plotter).

CalComp recently purchased a CAD program named CADPLAN, which has been marketed for the past year or two by Personal CAD Systems. The company has rewritten and upgraded the product, added new device drivers, and issued the result as CADVANCE.

PC Magazine Labs' test of CAD-VANCE began on a very low note. Installation was a disaster. We tried to use a Verticom M-16 high-resolution color system with a Hipad digitizer, a perfectly legitimate combination according to the CAD-VANCE manual. The Hinad uses a very peculiar serial interface. We wired the odd cable required and could not get the pad to work. There was an occasional response from CADVANCE, so I knew the program was aware of the pad's existence, but 5 hours of experimentation did not yield correct operation: CADVANCE has one technician available for customer support. He was not even aware of which of the pad's output options should be used. The manual didn't mention this crucial fact, either.



Eventually, we determined that the Hipad was too slow to work correctly with the Verticom. The Verticom is quite fast as high-resolution color systems go, and this combination simply doesn't work. Cal-Comp should figure such things out before releasing the drivers or, at least, warn the

In any case, the Hinad did work reasonably well with another one of our computers, which has a Hercules monochrome graphics card. CADVANCE also worked with the Verticom and a Logitech Logimouse, although screen response in the normal graphics area was jumpy. CAD-VANCE continuously displays the current cursor coordinates (and this display cannot be disabled), and the constant updating interferes with digitizer input. Cursor response is perfect when the cursor is within the menu area, so the Logitech works fine. The cursor jerkiness is distracting and unpleasant, but deliberate movement of the mouse allowed (barely) acceptable perfor-

SUPERB COLOR Difficulties aside, the first thing you notice is the excellent use of color throughout the system, especially on the Verticom M-16, CADVANCE has a menu of options on the right edge of the display, with secondary menus appearing immediately to the left, as various options are selected. The menu uses green and yellow, with highlighting of the current option shown by a red box. The display grid is red, which is unobtrusive behind most of the other colors. Many commands have small option menus displayed in the status area at the bottom of the screen, and color is used well here, too.

CADVANCE also uses color to indicate screen objects you have selected-rather than the traditional dotting or strobing used by some other CAD programs. Most of the text screens use color to good advantage as well. Where the screen drivers in most competitive packages merely get the software working with a video adapter, CAD-VANCE's Verticom driver uses the device to much greater advantage. It displays small graphics characters in many locations to reduce the amount of room occupied by status menus and other messages without sacrificing readability.

USING CADVANCE CADVANCE uses two keys for most operations: the Space bar to make picks and the Esc key to cancel or complete the action of a command. If you use a mouse or multibutton digitizer, two buttons on the mouse issue the same commands, which is very fast and convenient

CADVANCE incorporates some fine concepts for drawing objects. Drawing an object with multiple line segments results in a "line set" that is handled as one entity for editing purposes. The component segments can be broken out, and the separate vertices can be displayed if needed. This is an excellent, intuitive method; when lines form an object on-screen, it is much more

 The first thing you notice about CADVANCE is the

excellent use of color throughout the system, especially on the Verticom M-16 color system.

sensible to manipulate the object as one en-

In addition to the normal line, circle, rectangle, and arc drawing commands, CADVANCE includes parallel lines with user-specified spacing and polygons of up to eight sides. Three types of multiplepoint curves can be drawn. The distinction between them, based on the mathematics of the curve-drawing algorithms, is poorly explained but appears to deal with whether the resulting curve passes through every point specified or only the endpoints with the curve modified by the position of the other points.

Text facilities are flexible. Text can be slanted, stretched, or compressed horizontally; justified; centered; rotated; and more. A generous assortment of 11 very attractive fonts is included with the program. Unfortunately, only 1 font can be used in a given drawing. The maximum length of a test string is determined by the video display used; low resolution allows only 40 characters and high resolution only 72 characters.

COMMANDS Objects to manipulate can be selected individually, in groups, or via windows. CADVANCE also allows you to select Multiple windows, a good enhancement to normal methods. An extensive array of editing commands is provided. The Delete command only marks objects. As with dBASE, they are not actually removed from the object database unless a Pack command is issued. Objects can be rotated to any angle, but the angle must be specified at the keyboard. CAD-VANCE uses dragging to show the effect of other projected commands, and the Rotate command would also benefit from this technique. A Scale command can easily change the size of any object, and objects can be readily moved or copied. A Fillet command to join or trim lines is included, but no chamfer capability is provided.

A fascinating set of editing commands move, add, and delete vertices (the internal endpoints of line segments in an object). Good use of dragging allows visualizing the changes before they are finalized. A Break command opens lines, arcs, and circles. The Trim command chops any obiects over which a line falls; it can be used to shorten a line or cut a heavy swath through several objects. The Fix, Cross, Open-T, Close-T, and Open-Y commands perform lovely clean-up operations on parallel lines. A fancy Open command opens parallel lines to insert doors and windows. Other editing commands are provided to change layers, edit text, and more.

The program provides an unusually flexible and convenient system to modify screen windowing and other display characteristics. Zoom, Pan, Grid, View, and Macro commands are called "nested" commands and can be issued while executing any other CADVANCE command, which avoids the procedure common to most programs of terminating a command, issuing Zoom or similar instructions, and

returning to the original command. The Zoom command can

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a window, in or out to a center point, or by magnification or reduction ratio. The zoom ratio available seems more limited than with some other CAD programs; it is not difficult to reach the minimum or maximum size. A Fit command adjusts an image to fill the screen. Pan moves in userspecified increments or by screenfuls in any direction. The grid can have different increments horizontally and vertically and can also be aligned with a point. Up to ten grid specifications can be stored and recalled instantly. Ten "views" of a drawing can also be stored (designated with digits only) to eliminate the need to pan around a complex drawing.

CADVANCE links snap to the grid, which may be more intuitive for many users but is somewhat less flexible than keeping the snap and grid independent. Snap can also be linked to a node, a vertex, an intersection, or the nearest line. These object snaps are good as far as they go but are not as varied as the object snaps provided with some connectitive programs.

CADVANCE's dimensioning system is very easy to use, especially the Auto option, which searches a window and automatically creates dimensions. However, the available options are relatively limited. For example, there are no leaders, angular dimensioning, or baselines, and the styles are fixed rather than adjustable.

Hatching (called Texture by CAD-VANCE) uses only diagonal lines, although rotation can yield horizontal or verical lines. Spacing is user-specified, with an interesting random-spacing option. Complex patterns cannot be defined or used for hatching. Textured lines are an interesting idea; they repeat patterns that you can define.

Up to 127 named layers can be used, with different colors assigned to each. Layers cannot only be displayed or hidden, but they can also be rendered inaccessible. A Query system displays line lengths, areas, and volumes (there is no three-dimensional module, but CADVANCE asks for the thickness of selected objects in order to calculate their volume).

The block (called Symbol) system makes defining and inserting symbols easy. However, symbols cannot be sized or rotated on insertion, although the nor-

mal editing provisions can be used for these functions at the cost of some extra steps. The problem with this design is that symbols have to be created in an appropriate size for different drawings to avoid symbols that are initially much too big or

small. The CADVANCE origin system places the origin in the center of the screen, with negative space below and to the left of the origin. This is probably equally as valid a method as the lower-left origins used by most competitors, but the use of negative numbers may be confusing to some operation.

numbers may be confusing to some operators.

CADVANCE provides four types of coordinate display: absolute, relative to the

 The CADVANCE software provides an unusually flexible and

convenient system for modifying screen windowing and other display characteristics.

last designated point, and polar relative and polar absolute, which show angles. This flexibility is useful, but as mentioned earlier, some provision for disabling the coordinate display should be included with the program.

the program.
File management facilities are good, Indediction to the normal file manupulation
for the normal file manupulation
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USER HELP The CADVANCE help system is superb. A Help command displays a masser screen from wheth you can
mands. If help is requested while recurmands. If help is requested while recuring a command, the help is context sensitive. The help itself is not merely cryptelsummarise; it is multiple pages of
uniformative instructions and suggestions. The CADVANCE help systems
far and away the best of any of the CAD
systems tested.

System to Section of the Control of

off-line. Two mechanisms are provided for creating and running macros (sequences of instructions). The simpler uses a "learn" system to record your interactive commands. Any actions that can be taken from the keyboard or digitizing device can be stored for future recall, with the commands assigned to a key. Hitting FI and the chosen key replays the series of instructions. This is a fast and simple, albeit limited, way to save time and labor.

For more-complex operations, CAD-VANCE includes a macro language complete with variables and high-level language-type statements. Integer, real, and string variables are available, designated with a letter and single number like old versions of BASIC. The language's keywords are divided into two classes: those that issue an instruction to CAD-VANCE itself and those commands that are internal to the language. Statements are provided to obtain user input of various types, with prompts and range checking: change the cursor type; establish labels used with GOTO statements; convert data from one type to another, perform trig metric functions; change sta



■ It is very difficult for any CAD program to compete with the tremendous third-party support and marketing

tions (with rather cryptic numeric op-

clout that AutoCAD

enjoys.

codes), select menu entries; and more. Macro files can be created with any text editor or word processor, or CAD-VANCE's simple internal file editor can be used. Macros can be quite complex, with math and variable manipulation done internally. Careful documentation is a must because the macro code is not particularly easy to read without an in-depth knowl-

edge of the intricacies of the language. The major enhancement Call Comp added to CADPLAN is a database extraction facility. CADVANCE allows you to define the text and numeric information to be attached to a graphic element. Incressingly, CADVANCE can assign attribute properties to layers as well as individual entities, so, for example, one layer could represent 5 percent tolerance resistors and another 1 percent tolerance parts.

The complete database process is a bit too lengthy to discuss in detail here. In essence, CADVANCE outputs a file containing data from the attached attributes. The program allows you to extract data from a window area instead of automatically extenting information from the entire drawing. This adds [lexibility in manipulating day subassembles, office areas, and

e system then can edit the attrion, append and delete revise manage the data.

de defined (in one
a form of rethematical
"enorts can be generated, and the output files are directly accessible by the dBASE database manager for additional manipulation and control.

Other CAD programs include attribute or tag facilities, but they don't do anything with the extracted information. Creating reports requires programming in some high-level or database language, CAD-VANCE has provided these facilities as part and parcel of the package. The system works well and is very flexible.

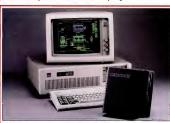
CONCLISSION CADIANCE is marted by the jarly mouse response (not to mention the Hipad debacle), but orderwise the system has much to offer. The program worked fine with a Hercules graphics card, but you miss the marvelous use of color. The user interface is fast and easy to use, and the menu system, the status line adjustment provisions, and the ready accessine the color of the state of the color of the co

Some of the subsystems, like dimensioning, hatching, and object snap, do not offer the range of options provided in AutoCAD or some of the other competitive programs, but CADVANCE partially compensates with many creative and useful functions. Several such features are main menu items that must be simulated through macros with AutoCAD and other CAD packages. The range of hardware supported is relatively limited. On the other hand, the database extraction facilities would also be an extra cost prospect with custom programming or external third-party programs with other CAD systems.

As this article went to press, CalComp announced the release of CADVANCE Version 1.10. The new release will enhance Version 1.0 in several areas, including the addition of multiple fonts per file capability, improvements in area texturing, and an expanded list of supported dispatible very compared to the supported dispatible very compared to the very compared to the very compared very compared to the very

CADYANCE a more attractive buy.

Still, it is very difficult for any CAD program to compete with termendous Department of the termendous that the competitive in the competitive in the competitive in many respects other than price. It doesn't loaded AutocAD, it is competitive in many respects other than price. It doesn't offer any terribly major advantages, however, and prospective purchasers will have to look lockedy at the range of hardware to look lockedy at the range of hardware offered by CADIANCE versus some offered by CADIANCE ver



CADVANCE makes marvelous use of color and has some interesting tricks up its sleeve.

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CAD programs make unusually heavy demands on personal computers. The optimal hardware

configuration for CAD includes a high-performance personal computer (AT or AT equivalent), preferably equipped with a faster-than-standard clock chip, two serial posts (the first for the digitizer and the second for the plotter), and an 8087 or 80287 math coprocessor.

Probably the most critical harden Robably the most critical salepter and and monitor to use. Since the standard IBM Color system suffers from barely acceptable resolution in single-color mode and unsatisfactory resolution in four-color mode, the only reasonable low-cost option is the Hercules mooned; the only reasonable low-cost option is the Hercules most probable to the cost of the probable to the cost option of the color of the

As with many things in life, such limitations are readily overcome by the liberal application of more money. IBM's Enhanced Graphics Adapter is far better than the base IBM Color Graphics Adapter, and cards like Sigma's Color 400 (640 by 400 with 16 colors) are even better. A Sigma and a suitable monitor run about \$1,600. Moving upward, 640 by 480 cards and monitors like the Verticom M-16 run about \$3,200, and IBM's Professional Graphics system and compatibles are somewhat more. Up in the stratosphere you can find super-high-resolution color systems offering up to 1,024 by 1,024 resolution. Acquiring such detail will set you back upwards of \$5,000.

The PC's cursor keypad is a weak substitute for a real digitizing device. The best (and most costly) option is a digitizing tablet using either a pen-like stylus

HARDWARE:

FIRM SUPPORT FOR

CAD

CAD programs ask a lot of your PC and peripheral hardware. So, high-end equipment may seem expensive now but

will pay its keep in increased productivity over the long haul.



or a puck with one to 16 buttons. The puck is better for tracing in preexisting drawings,

but many users find the stylus more like a normal drawing instrument. Tablets further allow you to place tablet menus on the pad if your CAD program supports them. Using these menus can be much faster than those on-sercen. Tablets are available in many sizes, larger tablets are better for tracing in old work, but 11- or 12-inch square tablets are better for tracing in old SoOp-\$1,200 are the norm and work well for most applications.

Some CADs support mice as an alternative to a tablet. A mouse is satisfactory for drawing input, but because it's a relative device, tablet menus cannot be used. Some CADs also support joysticks, but most users find joysticks much less satisfactory than tablets or even mice.

Most CAD systems support a long list of plotters. Some CADs also can draw to a dot matrix or laser printer, but output created with these devices is usually too small and inaccurate for finished drawings. The main determinant in plotter selection is the maximum plot size the device can draw. Most serious CAD environments require "E" size plots (36" by 48"), although "D" or smaller plotters have their uses too. Here again, speed counts: plotter throughout can be a major factor in a commercial system. especially if you work with complex plots. A printer buffer can further save time by storing plotting commands while you work.

The main lesson to learn before choosing hardware for a CAD system is to weigh your investments wisely. Equipment that seems inexpensive now may end up costing more over the long haul in terms of throughput and efficiency.



PENCEPT PENPAD WITH PENCAD

AutoCAD supports a long list of digitizing devices, both tablet pads and mice. For the most part, all the tablet digitizers function similarly. The only distinctions are whether a penlike stylus or a pucklike cursor is used, how many buttons a puck has, and how large the digitizing surface is. There are some internal design differences, but after a while one pad looks pretty much like another.

One notable exception is Pencept's Penpad, Penpad performs the normal function of a digitizer it is an absolute pointing device that sends the x and y cochditates of the current stylus location to the PC. Its software allows it to act like software allows it to act like you'll see, PenCAD software marries the Penpad to the Auto-CAD system in unique ways that make it an indispensible nancement for resistive productivity.

HANDWRITING ANALYSIS Even with its standard software, the Penpad is much, much more than a conventional digitizer. In many ways, it is one of the first microcomputer products to make productive, real-world use of artificial intelligence techniques: Sophisticated hardware and software give the Penpad the ability to read hand-printed characters! The Penpad can recognize nearly anyone's printing because it decodes penstrokes rather than the actual shape of a finished character. Some characters can be printed in more than one way, and Penpad will almost always get them right immediately. The only deviation you must make from normal printing is that you must print the letter I with the "hat and foot," or Penpad thinks it's a number one, and the system will interpret zeros printed without cross slashes as the letter O. Neither requirement is a burden, however, especially given the wide variety of printing behavior the system can accept without change.

The system accepts letters printed nearly anywhere on the pad's surface. Pencept offers a package called *Penform*, which allows custom forms to be positioned on the pad. Clerical or order-entry personnel can then enter data directly into the computer

simply by filling in boxes. When used this way, the top portion of the pad can be programmed to issue cursor movement, function key, and other commands directly to DOS, completely eliminating the need for a keyboard. Another Pencept program, Pendraw, is a free-form artistic product that uses the Penpal to import and enhance graphics images from CAD or presentation graphics packages.

The Penpad can be instructed to accept only uppercase, both lowercase and uppercase, or numeric-only input. Actually, you must always enter letters in uppercase, but if the lowercase character set is enabled, you print letters intended to be interpreted as lowercase in the bottom half of the text-

The Penpad is an elegantly styled device, at least as digitizing pads go, featuring muted shades of beige, a comfortably padded handrest, and a low profile. The stylus is slim and easy to hold. Normally the stylus holds an empty pen refill, but ink refills can be used if the application calls for actually writing on paper. A button on the side of the pen acts as the keyboard's Return key.

Unlike most digitizing instruments, the Penpad is not a serial device and doesn't connect to a serial port. Instead, the unit requires a full-length IBM-compatible interface card, which occupies one slot in the PC, XT, or AT. A Motorola 68000 microprocessor and 128K of ROM on the board



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List Price: \$1,495
Requires: 128K RAM, DOS 2.0 or later, one disk drive.
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supply the computing horsepower the system's advanced functions need. The Penned gets its electrical power from the PC's power supply through the interface card, so that it needs no direct connection to an AC line.

The standard Penpad software is a driver that you load either from the keyboard or from an AUTOEXEC BAT file. Once loaded, the driver stays resident in memory, so you need not reload it unless the computer is reset or turned off.

PENCAD Until recently, however, the Penpad was more a fascinating curiosity than a real workhores. Now the excitement centers on a new program released by Pencept named PenCAD. PenCAD, as its mannet inplies, is an interface between the new with CADVANCE and possibly other to come. Simply put. PenCAD totally changes your interaction with Auto-CAD is. Improves productivity tremendously for any Auto-CAD user and eliminates a major obstacle for nourophies who wish to learn the program of the company of the control of t

The template supplied with PenCAD uses the top portion of the tablet as a control area, with room for a 16-character text string, eight command scripts, and a section for choosing which character set to employ. You use the rest of the pad for screen digitizing and selecting commands from the normal AutoCAD on-screen menus. The newest version of AutoCAD includes a special driver and modified AutoCAD menu that allows the stylus to issue secondary commands, as the multiple buttons on a puck might. This feature is convenient and worth the modest cost of obtaining the new driver from Autodesk. Pencept includes its own driver for use with AutoCAD versions prior to 2.17F, which does most of what the newest version does.

PEN MACROS The ability to enter the short commands and texts commonly used in AutoCAD is very useful, but the main event is what Pencept calls "recognition macros" or "pen macros." You can define 37 such macros: one for each letter of the alphabet, the digits 0-9, and the dollar sizn. When the stylus button is held down and the desired character printed anywhere in the digitizing area at any size, the macro is executed.

ACC comes coupleyed with very reasonable macro definitions for the alphabetic macros. It supplies a simple utility reasonable macros change these definitions and assign the functions to the numeric macros and the ciglip boxes at the top of the pad. You can enter a short string of characters to lated the macros. When the definitions are complete, AssociAct policy and the top of the proportion of the Peppel off you plan to use commercial templates like the AECADD system; they pen macros still work in such

an environment. It is difficult to convey the dramatic improvement in case of use and throughput that PenCAD brings about. In most Pepileations, 80 percent of the activities are performed by 20 percent of the activities are performed by 20 percent of the available commands, a pattern that scene to hold for MancCAD, to Lumping around the Astro-CAD screen menus is time-consuming through. Any table to menu can help, but it takes up valuable digitizing space and distracts the user's attention. PenCAD survivos don't suffer from these limitations. They intervitive scenalessly into the flow

of normal drawing and editing.

Entering text at the Penpad eliminates
the need to swivel from the digitizer to the
keyboard—even more of a disruption. I
am a fast typist, but when I use the Penpad
and PenCAD with AutoCAD, I simply

don't touch the keyboard at all. The Pennad system costs \$1,495 including the pad, interface card, driver software, and choice of PenCAD, Pendraw. or Penform software (each software item costs \$195 separately). Conventional digitizing pads of similar size tend to cost around \$1,000, so the increment for the intelligence offered by PenCAD is minimal considering the overall cost of most Auto-CAD systems. This is one item where the return on investment is high and almost immediate. The only possible reason you might not want a Penpad/PenCAD system is if you need a much larger digitizing surface for tracing existing artwork into Auto-CAD. Otherwise, I strongly recommend the Pencept system. It is really superb!



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THE CALCOMP 1043GT PLOTTER

Minicomputer and mainframe CAD users have long enjoyed large and solid E-size plotters. Manufacturers like Hewlett-Packard, Nicolet, Houston Instrument, and CalComp offer heavy-duty and expensive plotters to serve this market.

CalComp introduced its relatively lowpriced 104X series of E-size plotters some time ago. The 104X series—offering the first plotters priced below \$10,000 capable of producing such large plots—has been a big success. Among these the 1043, a plotter that uses cut-sheet media only, has been the greatest hit—probably because it is also the least coolsty at \$8,905.

also the least costay at \$8,90.5.

Now CalComp has upgraded the 104X with new ROM firmware that optimizes pen movement for greater throughput. The new models are designated "OT" to convey their higher plotting speeds, and PC Magazine Labs tested a new 1043GT for this project.

THE SPECS First impressions of the 1043GT were first impressions of the 1043GT were flower for the content of the with a massive sturdy-looking stand. It comes with locking casters for moving it around. Construction quality is excellent, fully befitting a high-end device. Compared with lesser plotters, every aspect of the 1043GT's design is heavy-duty and solid, promising a long, deependable life in commercial environments.

The operator panel is by far the most



functional and attractive of any plotter reviewed in this issue or as part of the competence because the process of the proces

The 1043 of offers a plethora of functions, including establishing the plotter's operating parameters and resetting the plot origin, media size, limits, pen types and speed, acceleration, and down force. It allows you to scale plots either larger or smaller and to rotate from 1 to 259 de-

grees. A nifty "'de-skew" function aligns the plot to the media edges, even if the media has not been loaded into the plotter perfectly straight. Plots can be scaled to compensate for paper expansion or shrinkage caused by humidity.

The plotter comes with an excellent joystick, which you can use to position the pen head over any portion of the paper instead of using the operator panel direction keys. Speed of movement is determined by how far from the center the joystick is held, and a manual pen up/down button is located on the top of the sixty.

The tremendous range of possible settings could make setting up the 1043GT a complex procedure. CalComp includes a supplementary sheet with detailed instructions for setting the plotter for use with Auto-CAD. Fortunately, following these to the letter and using the supplied serial cable worked the first time. The 1043GT can



The CalComp 1043GT is big, with a massive, sturdy-looking stand and locking casters.

store four completely independent setup configurations for different users—a convenience when people with different plotting requirements are sharing the plotter. All configurations are stored in nonvolatile EEPROM, so they are retained when power is off.

PENS AND MEDIA Pens are held in a removable eight-pen turret. The plotter is smart enough to 'mapi' empty pen stalls to other positions where pens are available, so plotting will never be ruined, even if you specify an empty stall. Each pen is automatically capped within the turret to prevent drying during a plot.

The plotter holds down the media with a combination of pinch rollers, grit wheel, and vacuum hold. Translucent, bond, or wellum paper and mylar film can be used. The left pinch roller can be moved to science the commodate different paper sizes, up to E size. The 1043GT uses only cut-sheet media, but other, more expensive models in the series can use roll media as well. The roll paper mechanism is more sophisticated than the simple but that holds roll media in other plotters like the loline LP3700 and

should result in better-quality plots through superior media handling.

The 1043GT stores its intelligence in plug-in ROMPACKs, which you insert in a slot on the side of the plotter. This makes changing the firmware easy as the upgrades are released.

TESTING. Plotting a B-size AutoCAD and nozzle with disposable liquid-link, fifter-tip, and liquid-trisk ball pern stoot from 2 minutes and 40 seconds to 2 minutes and 50 seconds. This differential is summained to the stood of the stood of

plotters PC Magazine has tested to date. More importantly, plot quality was flawless. The diagonal lines of the nozzle. which can cause problems for many plotters running at the edge of their capabilities, were perfect-rock solid and absolutely straight (see accompanying sample). The 1043GT clearly runs well within its first-rate capabilities at the default pen speeds. The 1043GT has a rated resolution of .001 inch (compared with .025 inch for the Ioline), and this undoubtedly contributes to the superb results. The plotter actually is set for 2,032 steps per inch, more than twice the rated resolution, but Cal-Comp believes the conservative rating compensates for minor differences in pen tip width and paper movement errors.

Itried increasing pen speed to the maximal 14 jas with liquid ink, pen to see if qualify might degrade slightly. Both plot qualify might degrade slightly. Both plot intent and qualify were essentially identical, indicating that Auto-CAD might not be able to push the plot instructions out to a plotter any faster. Perhaps the 1043, and for that matter the Nicolet, could plot even faster with a higher-speed computer. My 8-MHz AT with a fast Tallgrass hard disk seems to be about the speed limit for current-generation microcomputers, though.

The CalComp's 6 to 14 ips throughput is especially surprising compared with the Nicolet's rated pen speed of 25 ips. Some

CAD Hardware Video display options (continued. Control Systems Artist I Frontier BIZgraph-1 GraphAx 20/20 Hercules Graphics Matrox 640 Number Nine Revolution Persyst BoB Multigraph I Quadram Quadscree Quintar Scion PC640 Sigma Designs 400 TAT Galaxy G-500 Tandy 2000 Tecmar Graphics Master Montrix Verticom M16

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credit goes to the new GT firmware, called Plot Manager, CalComp claims throughput increases of 30 to 50 percent.

The new GT version of the 1043 sells for the same price as a non-GT plotter. The GT has a 24K buffer, necessary for scanning ahead in the drawing for the pen optimization, so the new unit actually represents a slight decrease in price. Owners of older 1043s can add the GT option at a cost of \$1,995. This seems a bit steep, but new hardware, ROMs, and on-site installation are included. The greatly enhanced throughput will pay out this investment over time.

The fact that the CalComp 1043GT stands out compared with the much-lowercost plotters is perhaps not so surprising, although you don't always get what you pay for. The real story is that the 1043GT offers performance that rivals plotters costing many thousands of dollars more. It is a thoroughly impressive unit.



IOLINE LP3700 PLOTTER

Occasionally a product breaks through established price barriers, opening new markets previously out of reach. The Ioline LP3700 plotter from Ioline Corp. is such a device. Until recently, plotters capable of drawing E-size plots (36 by 48 inches) cost at least \$10,000. The CalComp 1043GT (also reviewed in this issue) was the first plotter to break through this price point at about \$9,000; now the loline LP3700 enters the market at an unprecedented \$4,995 list price. The little guys can now make the big plots, but does such a remarkable price entail tradeoffs somewhere? PC Magazine Labs put the loline LP3700 through its paces to find out.

THE SPECS The 3700's physical design is similar to that of the Houston Instruments DMP-41/42/51/52 series, but construction is sturdier; the plotter alone weighs nearly 50 pounds. Even the supporting stand is solid, with locking casters to aid in moving the plotter from place to

place. Paper hold-down is achieved by the concerted action of capstan rollers held against a rotating grit wheel and a vacuum system. The rollers can be moved anywhere along their support rail, allowing the 3700 to handle media in sizes from strips only 11/2 inches wide up to slightly larger than E size. The unit can also accommodate roll paper through the simple vehicle of a crossbar to hold the media. This flexibility is unusual; most such plotters handle only two large sizes (with media positioned either vertically or horizontally) or require special adapters for smaller media sizes. The ability to produce A- or B- size plots is very useful for draft or intermediate plots and saves money by reducing both the time to plot and the cost of

The 3700 has a 24-position membrane keyboard that gives you good control over plotter behavior. The pen head can be moved manually in any of eight directions at three speed levels, depending on the operating speed chosen. It allows for movements in 2.5-mil increments for precise

be reported back to the computer (digitizing), plots can be scaled, plot limits can be specified, delays can be added to movements for certain types of pens, and plot speed can be controlled. Ten LEDs indicate various operating modes.

A wide variety of nens is available for the Ioline LP3700 Plotter. It can use Staedtler or Hewlett-Packard-comnatible liquid-ink, disposable fiber-tip, or rollerball pens. The pen adapter will also accept custom-fit pens

The Ioline LP3700's specifications are reasonably good. Resolution is .0025 inch, not quite up to plotters capable of



The Ioline LP3700's operator panel.



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.001 resolution, like the CalComp 1043GT (see previous review), but not bad either. Speed is 10 inches per second axial and up to 14 ips diagonal, again neither the fastest nor the slowest available. The plotter has a 14,000-byte internal buffer, which increases efficiency considerably.

The 5700 uses a standard RS-232 interface with a straightforward connection scheme. Like many other high-and glotters, the 3700 comes equipped with two serial ports. Normal connection to a computer uses only one, but the plotter can pass through data to a terminal connected to the other port. This feature is occasionally used in minicomputer or mainframe environments, but does not mean much to microcomputer users.

SPEED TESTS 1 used the ubiquitous Anto-CAD rotate drawing to test plotting speed and quality. Running the LP3700 at 9600 baud and 10-inch-per-second pen speed on my 8-MHz AT with 6-00% and per speed on my 8-MHz AT with 6-00% and 10-inch-per-second pen speed on my 8-MHz AT with 6-00% and 10-inch-per-second pen speed on my 8-MHz AT with 6-00% and 10-inch-pen speed on my 8-MHz AT with 6-00% and 10-inch-pen speed on my 8-MHz AT with 6-00% and 10-inch-pen speed on my 8-MHz AT with 6-00% and 10-inch-pen speed on my 8-MHz AT with 6-00% and 10-inch-pen speed on 10-inch-pen spee

Unfortunately, although overall accuracy was pretty good considering the step size, diagonal lines were not particularly well drawn. Waviness in such lines is often





CAD

Hardware



an indication of hardware that is running too fast for optimum quality. To check this, I plotted the nozzle at 8, 4, 2, and 1 inches per second.

The results are shown in the graph (see Figure 1) and magnified plot samples. As pen speed was reduced, diagonal line quality improved. However, even at the agonizingly slow speed of 1 inch per second. the diagonals were not perfect. Most users will find 2- and 4-ips plots acceptable and would be likely to agree that the faster plots do not meet the most critical professional standards

Plots consisting of mostly orthogonal lines looked good, even at the higher speeds. Many users who produce schematics, floor plans, or similar types of plots could achieve fine results even with the LP3700's higher speeds.

Ioline claims that the LP3700 follows the Houston Instruments DMPL graphics language, and so I checked this statement Even at the

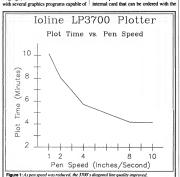
agonizingly slow speed of 1 inch per second, the Ioline LP3700 Plotter's diagonal lines

were not perfect. driving DMP-series plotters. All worked without any problem; the Ioline can be

used with a wide variety of software. By the time this evaluation appears, Ioline will be offering a buffer option that includes 512K of buffer memory and optimizing algorithms akin to those offered in CalComp's new GT line. The buffer is an plotter or retrofit in the field. At only \$900, this option looks like an efficient way to increase the 3700's throughput.

CONCLUSION Overall, the Ioline LP3700 must draw somewhat mixed reviews. Construction quality, flexibility of media size and pen selection, and software compatibility do not suffer because of the unit's low price, but performance does, especially at the plotter's higher speeds. The use of stepper motors rather than servos and the resulting accuracy loss, the singlepen design, and other tradeoffs will mean more to some users than others

Are the tradeoffs worthwhile? If you need E-size plots (and many CAD installations do need the large drawings), the loline LP3700 is by far the least-expensive plotter available that can deliver the goods. If Ioline can improve plot quality a bit, it could have a tiger by the tail.





ple from the Ioline LP3700 Plots

AUTODESK'S CAD/CAMERA AND THE DATACOPY MODEL 700

A good CAD system's arsenal of drawing commands is impressive, but there is no question that entering a complex drawing can be time-consuming and even tedious. Similarly, tracing in existing hand-drawn graphics on a digitizing tablet can be a painstaking process.

Owners of a mini or mainframe CAD system with an extra \$150,000 or \$200,000 lying around can avoid such a mundane effort by buying a digitizing scanner or camera. But until recently, this option was unavailable to users of microbased CAD systems like AutoCAD, regardless of how much they had to spend.

priced optical scanners is beginning to make rapid graphic entry more affordable. These devices can also be used for optical character recognition and other applications.

A digitizing camera and optical scanner

FACT

Datacopy Model 700

1215 Terra Bella Ave.

Mountain View, CA 94043

with very high-quality results

ROLE 672 ON READER SERVICE CARD

Requires: WIPS software requires 512K

RAM, hard disk drive, DOS 2.0 or later

Requires: 512K RAM, hard disk drive,

In Short: Converts digitized raster files in

vector files readable by AutoCAD. Slow a

creates only fair-quality images, but can't beat for the price.

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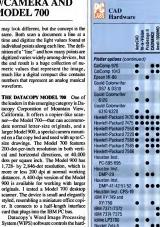
FILE



the leaders in this emerging category is Datacopy Corporation of Mountain View, California. It offers a copier-like scanner-the Model 700-that can accommodate normal letter-size originals, and a larger Model 900, a special camera mounted on a flat copy bed and used with up to Csize drawings. The Model 700 features 200-dot-per-inch resolution in both vertical and horizontal directions, or 40,000 dots per square inch. The Model 900 has 1,728- by 2,846-dot resolution, which is more or less 200 dpi at normal working distances. A 400-dpi version of the Model 900 is available for working with larger originals. I tested a Model 700 desktop scanner. The device is small and elegantly styled, resembling a miniature office copier. It connects to a half-length interface card that plugs into the IBM PC bus.

Datacopy's Word Image Processing System (WIPS) software controls the hardware and creates and manages digitized images. It requires a Hercules monochrome graphics card or an equivalent like the Everex, AST Preview, or the like, as well as a hard disk. You'll need at least 512K bytes of RAM-the full 640K bytes if you want to use the Datacopy optional advanced editor. Memory-consuming resident utilities are obviously a no-no with such a memory-hungry system.

Capturing an image is as simple as inserting the original into the scanner and selecting Capture from the appropriate menu. You can adjust the capture action for line art or either of two halftone screens



Penman

Roland DG

Radio Shack FP-215

Enter Computer's

Six-Shooter

Taxan KPL-710

Sweet-P 100 &

Watanabe/Western

Digitizer options

Graphtec MP1000

CalComp 2000 Tablet .

CalComp 2100 Tablet .

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nd be		l		
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for photographs or other continuous originals. Contrast can be set to three positions to make the image lighter or darker.

The capture itself proceeds very quickly: the entire process takes under a minute. As the scanning head and its fluorescent lamp move down the original, the scanned image appears on the PC display. A numeric counter shows the percentage of scan complete, which is useful for systems without graphics, but unnecessary with a computer with Hercules graphics because the image formation can be watched onscreen

The WIPS software's Zoom feature magnifies a fixed-size portion of the image. The window defining the zoomed area can be panned over the total image to select any small section to view. You use the cursor keys or a mouse to move the window, and modify the selected area with the WIPS Editor. Incidentally, WIPS uses the right mouse button for Return, the most common command in WIPS. This is

counterintuitive and a bit confusing. Images can be saved with an optional Huffman code compression mode. This method saves disk space but performs saves more slowly and works best only with line art images. You can also enlarge or reduce an image's horizontal and vertical dimensions. When you reload images, they normally replace whatever is on the screen. However, you can also merge an image on top of an existing one, with each individual new pixel either OR'd or XOR'd with the existing pixel in the same position. The visual effect of the two methods is quite different. You can also fit images into existing windows, truncate them, scale them up or down, or redefine the window to hold the image.

EDITING YOUR IMAGE WIPS's editing provisions are limited but interesting. A window area of an image can be erased or filled with solid color, and the image can be rotated 90 degrees to the right or left or flipped upside down entirely. The program has a complicated mechanism to merge pictorial images into text files; the procedure works well but requires some practice.

Datacopy offers a customized version of the PC Paintbrush program as an option. Renamed the WIPS Editor, it has a full spectrum of Macintosh-like capabilities to manipulate digitized images (or to create new images freehand, if you wish). The WIPS Editor includes an unusually varied set of tools like Paintbrush, Eraser, Spray Can, Line, Hollow and Filled Box. Circle and Ellipse, Paint Roller, Pattern Fill, a Pattern Erase, Scissors, Text, the movement Hand, and so on. Various commands accessed from pull-down menus allow cut and paste, tilt and rotation, fat-bit manipulation of individual pixels, font se-

lection (including both stroke and bit-

mapped fonts), and font style (including

proportional spacing). PC Paintbrush is an

excellent program, and the WIPS Editor

version adds tremendous flexibility to the

Datacopy 700 system.

SPECTACULAR OUTPUT WITH THE LASERJET WIPS can print to a limited list of graphics printers, including Epsons, the Hewlett-Packard Laserjet, and the OMS Lasergrafix laser printer. Printing on my HP Laseriet+ was slow, but the results were spectacular. The program also allows you to adjust the dots per inch, so you can attempt to accommodate the image in whatever buffer is available in the printer. the standard Laseriet can print a full page at 75 dpi, while the enhanced Laserjet+ can manage 150 dpi over a full page. In any case, the halftone pictures and line art that I put through the system looked magnificent on the Laserjet+. The resolution of the Datacopy 700 in real-world terms is superb. Even a letter printed on the Laserjet+ using 8-point fonts looked completely sharp when digitized and reprinted via WIPS

The documentation is printed with a daisy wheel and bound in an 81/2- by 11inch photocopied looseleaf binder. It is not particularly well written and includes many confusing sections and incorrect function names and terms, even when screens showing the correct language are immediately adjacent to the offending text. On the brighter side, it includes abundant screen illustrations and enough information so that experienced users should



■ CAD/camera is a conversion utility that "vectorizes" images created by the Datacopy Model 700 into Auto-

desk's .DXB format.

have no trouble finding their way around.

The Datacopy hardware and software are both first rate. Resolution is excellent, the system is extremely easy to use, and it's tremendous fun, too.

Autoclas's CAD/conter is basically a conversion utility that "vectorizes in ages created by the Datacop system in mages created by the Datacop system is command within AutoCAD can then read these lifes and create a normal AutoCAD with which is a command to the command within AutoCAD or any can use any of AutoCAD's drawing. Once this process is complete, you can use any of AutoCAD's drawing age and utilitately output it to any face the myriad potters and printers supported by AutoCAD.

Installing and operating CAD/camera is almost trivially easy. The program is installed once with a choice of either a Hercules or Quadscreen monochrome graphics adapter (or no graphics adapter or no graphics adapter or no graphics of the control of the program of the control of the control

you paid thousands for high-resolution color graphics. My Hercules system did work beautifully, though, especially with the superb Roland MB-142 monitor.

You can adjust CAD/camera to show variable-width lines as is, to smooth them out, or to scale the input by relating input pixels to AutoCAD drawing units. You don't need these features for normal work, but they add a lot of flexibility for dealing

out oney and a not of hextunity for examp with musual situations the program needs is the name of the image file created with the Datacopy scanner. Multiple files can be specified on the command line for unstanded operation. It agraphics system is in use, CAD/Comerca shows a "squashed" representation of the image on the left half of the screen, a magnified portion of the image in the upper right, and text messages in the lower right. The top line of the screen displays status information. You can be sufficiently in the deed portion of the image content in selected portions of the image content in selected portions of the image content in selected portions of the image content in the deed portion of the image content in the selected portion of the image content in the selected

SLOW-GOING Vectorization itself is a slow process. Autodesk claims the processing time is roughly similar to the time it would take to plot the image, but the images I tested took much longer than any plot. CAD/camera scans the image twice, first looking for lines and then looking for solid areas. A small block moves over the main image to show where the program is working, and the status line displays how much longer the process will take. Strangely, the time shown fluctuates up and down somewhat, but ultimately it does wind down. CAD/camera places the solids it finds on an AutoCAD layer called Solids. Lines are rendered as polylines in AutoCAD and are placed on a layer named Lines. It is interesting to examine the layers individually. CAD/camera creates far more lines than solids on most drawings.

A plot of the AutoCAD nozzle drawing, often used in promotional literature, took over 29 minutes to vectorize. Once fully converted, AutoCAD took 1 minute 48 seconds to read the .DXB file and create the drawing. Loading and displaying the original nozzle drawing took only 18 seconds. The vectorization times were similar tooks.



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HARDWARE
larly long on several other test items, and

any iong on several other use items, and some tests approached I hour for complete vectorization. Incidentally, these timings were performed on an AT with 640k bytes of RAM running at an 8-MHz clock rate, so they are faster than they would be on any normal AT or XT.

The quality of the converted drawings varied from very good to poor, depending on the attributes of the original art. Simple and clean originals converted beautify, while something in the Datacopy's half-tone process caused AutoCAU to render photographs as solid blobs. Most convertions fell somewhere in between. The nozale, for example, looked good overall, but the convertigation of the conver

A TIME SAVER Autockels is up from about the need to clean up drawings processed through CADicamera. The compensation of the digitization and vectorization process will still save a significant amount of time over entering drawings from scratch. My tests tend to support this contention, although some originals will be easier to clean than others. In many cases, using the WIFS Editor once the original has been digitized but before vectoration any slowled better results and save

tune.

The CAD/camera documentation is brief but adequate, befitting a program that is so easy to run and has so few options. The program's packaging is very attractive and also appropriate for such an expensive sinele utility.

CAD/camera's \$3,000 price tag seems on the high side, but the processes for raster-to-vector conversion and conversion to AutoCAD format must have cost quite a bit to develop. The combined cost of the Datacopy scanner and CAD/camera is still tremendously lower than previous systems with similar capabilities. The system would be much more useful if it could accommodate the D- or E-size drawings most serious CAD users work with, but both hardware cost and processing time would suffer. CAD/camera has its weaknesses, but if your requirements fit the system's limitations. CAD/camera can be a godsend.



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command sequences to a single experione.

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AD programs are powerful beasts, able to digest a variety of complex design and drafting projects for many different disciplines. But no single CAD software package includes all the specialized functions that all its varied users need. Even more limiting, the library of symbols unique to a particular discipline can be used only by the practitioners of that discipline. If sufficiently expert, CAD users can customize their own solutions. Another common way to adapt CAD packages is to use so-called "third-party" support software that adds functionality and specialized features to a CAD package. These ancillary programs,

CAD SUPPORT:

Autodesk's implementation of an open architecture philosophy and encouragement of third-party developers also contributes to

this happy situation.

With the burgeoning interest in CAD, however, many of the companies writing for AutoCAD are now beginning to release versions for other CAD programs as well. The list of third-party programs a wail able! for CAD - VANCE, CADREY, VersaCAD, and the others should increase over time. Lists of third-party software for the other CAD programs on the market are available from CAD programs.

Over 140 AutoCAD-compatible products appear in the new

EMBARRASSMENT

published by companies other than the one that supplies the central CAD package, are varied and plentiful.

As with other program categories, third-party vendors support the de facto standard CAD programs to a greater extent than they do programs with smaller market shares. Look at databases, for example. The market leader, Ashton-Tate's dBASE II and III, boasts many more thirdparty ancillary programs than any other database manager because, as a standard, its greater number of potential purchasers means a greater return on programming investment for the independent software houses that develop support software.

In the CAD field, AutoCAD from Autodesk enjoys a significant market-share advantage over the other CAD programs available for personal computers. Accordingly, AutoCAD enjoys the greatest number of ancillary support programs.

OF RICHES

Ancillary support software and books offered by third-party vendors can customize CAD programs for

can customize CAD programs for particular professions, add functions to them, or make them easier to learn.



version of the Autodesk Applications Catalog (Available from Autodesk, Inc., 2320 Marinship Way, Sausalito, CA 94965, 800-443-0100): templates; menu-creation utilities; interchange/conversion programs for DPAS, Intergraph, IGES, SCADA, TEK, and CADAM; font programs; coordinate geometry programs: bill of materials and estimating programs; and libraries of architectural details, civil engineering and land surveying, electronics, lighting, electrical control, landscape, plumbing symbols, and more. Various training aids like books, audio tapes, and video tapes are also available.

PC Magazine selected an assortment of CAD ancillary programs and materials, most designed to work with AutoCAD. They range in price and complexity from a \$25 tutorial to a \$1,000 master template. Here's a closer look at what such add-ons bring to the CAD environment.



AE/CADD MASTER TEMPLATE

AE/CADD Master Template, created by Archsoft Corporation and marketed by Autodesk, is designed for architects. While the template is what catches your eye first, AE/CADD is really much more: it's an enhancement to AutoCAD that increases your productivity by automating the drawing of walls, doors, windows, and dimensions. In addition to its clever scripts and advanced use of AutoCAD commands, it supplies a large number of predrawn shapes suitable for architecture. Symbols for structural components. plumbing fixtures, textures, toilet accessories, electrical design, appliances, furniture, stairways, and miscellaneous drafting figures are included.

At first plance AE/CADD appears to be a tablet menu gone overboard: You tape an attractive plastic sheet about a foot square to your digitizing tablet (a clever system allows you to remove and reinstall the template easily), and load ten floppies to the hard disk on which you have AutoCAD

stored. The template appears to be divided into many more than the four permissible tablet areas, but there are really only four zones cleverly divided into 454 little squares. After you copy the software to hard disk using the simple batch file provided (it's not copy protected), you configure the tablet with AutoCAD's TABLET CFG command. Touch the comers of the four menu areas and the small remaining screenpointing area; AutoCAD then knows what's where. A small number of the template's hundreds of predefined commands are simple AutoCAD commands or numbers and fractions. Most are sophisticated combinations of commands or symbols. With so many options available I cannot discuss them all here; I can mention only a sampling.

When you start AutoCAD with the AE/ CADD system active, you select either the 1/4- or 1/8-inch scale. The program almost always draws to a predefined scale. Throughout the system, exact sizes for images and text are often offered in on-screen menus (although you can override these choices with other sizes). For example,

panning is in increments of 18 feet horizontally or 10 feet vertically. While "thinking" this way is certainly possible with AutoCAD alone, the discipline imposed by AE/CADD makes this thought process easier. The results are consistent drawings and greater ease of operation.

Advanced AutoCAD features like object snap and layers are used in most operations to make drawing faster and easier to control. Objects appear on 61 distinct layers, many of which are assigned different colors for screen display. On the superb Verticom M-16 video system used for these tests (640- by 480-pixel resolution in 16 colors), the result was a multicolored spectacle that greatly enhanced the readability of the complex plans AE/CADD produced.

AE/CADD uses AutoCAD's dimensioning provisions throughout to assure accurate drawing. However, the program instructs you to dimension rooms first and then snap the walls to the dimensions, the reverse of the usual AutoCAD style. The program enables you to specify wall thickness and even accommodate walls that vary in thickness or that meet at other than right angles. It uses a clever system to clean up overlapping parallel wall lines, allowing you to rapidly enter drawings without loss of accuracy. You can readily insert sliding, garage, single- and double-leaf



doors, and other door styles, as well as various types of windows. You can also drag

room names, wall and consultant lists, schedules of drawing, titles, and text. AE/ CADD also has a boldface type capability not available in AutoCAD You can select many of the predefined

shapes merely by picking their little boxes with the digitizer's stylus or cursor. Even with the hundreds of available boxes, there isn't enough room for all the symbols that come with the package, so you can also display on-screen menus that offer still more choices.

As you add many different items to a drawing, AE/CADD uses the AutoCAD attribute system to request information on an item. For example, it requests 17 attributes for a door, including such characteristics as width, height, number, room name, type, hardware, rating, construction, glass, finish, thickness, frame construction, frame finish, header detail, jamb detail, sill detail, and remarks. The list is equally comprehensive for plumbing fixtures and the like. You don't have to enter the information at insertion time; you can add data and/or edit it later. You can also tag attributes onto custom doors and other such items as well

A few of the data items AE/CADD has collected are displayed on the drawing for identification, but most are stored internallv. AE/CADD includes interfaces to both Lotus's Symphony and Ashton-Tate's dBASE II. If you own either of these programs, you can create detailed schedules of the items that a drawing comprises.

You can jump back and forth between the AE/CADD menus and the normal AutoCAD screen menus. AE/CADD's onscreen help uses scripts to demonstrate the sequence to follow for several common actions-an excellent idea.

All this information may sound confusing, but it's not really. It's a testimony to its excellent design that AE/CADD actually simplifies the creation of a floor plan with AutoCAD. AE/CADD's ready access to standard commands, useful scripts that perform advanced functions with one se-





Autodesk, Inc 2320 Mazinship Way Sausalito, CA 94965 (415) 332-2344 List Price: \$1,000 ires: AutoCAD. dBASE II or Sympl

for schedules, compatible video adapter, 10megabyte hard disk, DOS 2.0 or later. In Short: A massive, efficient template system for architects; adds many functions not included in AutoCAD and provides megabytes of symbol libraries CIRCLE 650 ON READER SERVICE CAR

lection, accurate shape libraries, and other aspects combine to make architectural drawing much more efficient and pleasant.

Admittedly, the system is massive. A lomegabyte hard disk is a bare minimum, and a 20-megabyte or larger fast-access disk is better. The AECADD memus and shape libraries are large and can take a while to load, and so the faster the hard disk you have, the better. Similarly, and SORY or 802.87 mush coprocessors is useful, but that's true of Auto-CAD as well. Final-CADD are rather small. a high-resolution color system or Hervules monochrome system is desirable.

Before I used AE/CADD, I thought \$1,000 a bit pricey for a template and tablet menu system. Exposure to the system has shown me that it is an excellent value. The increased productivity you achieve using AE/CADD will quickly cover the initial

Autodesk indicates that AE/CADD is only the first of a series of similar vertical market enhancement systems it is planning to develop for other professions. If the one's to come are as good as AE/CADD, I wait impatiently.

AUTOWORD

While AutoCAD has reasonably flexible provisions for displaying text, text entry and editing can be cumbersome. Other than erasing text and reentering it, the only way to edit is with the tedious Change command method. If you must add a few words in the middle of a block of text, for example, all the following lines may well have to be completely redone.

AUTOWORD, a simple text conversion utility from Technical Software Inc. of Cleveland, Ohio, accepts text files in standard ASCII format created by any worp processor or text editor. It will also accept files produced by WordStar's document mode. Text lines can be up to 255 characters long, and the program can accommodate an airnost untilinited number of lines.

AUTOWORD creates a file in the standard AutoCAD DXF exchange format. The resulting file can be read into a new AutoCAD drawing; AutoCAD then draws the text on the screen. Each line of the text is now a normal AutoCAD entity and can

be manipulated as any other text can be.

AUTOWORD's developers have thrown in a few niceties to make the utility even more useful. It supplies expanded

■ Before I used AE/
CADD, I thought \$1,000
a bit pricey for a template
and tablet menu system.

But experience shows it is an excellent value.

versions of the four standard AutoCAD type fonts (TAI, Simplex, Complex, and Italic). Subscript- and superscript-size characters have been added to AUTOWORD's versions, which are otherwise identical to Autodesk's. You can also use the text features bulk into AutoCAD including underscore, overscore, and special symbols—in AUTOWORD text files.

One of AUTOWORD's nicest features builds columnar tables, drawing optional grid lines around each item. Since tables of parts, object counts, and other items are common in AutoCAD drawings, the AUTOWORD table feature is very useful.

The actual conversion process is simple and fast. The program displays the type font, size, distance between lines, and other text attributes, and you can change any of the default values. The program requests the names of the input text file and the output DXF file and then goes about its business. Batch files are available to automate this simple process; they might be useful to execute AUTOWORD from with-nameCAD by using the Shell command.

AUTOWORD converted a series of test files without incident. Even complex blocks of text took only a few seconds to convert. AutoCAD read in the resulting DXF files easily. The text filled the screen

and thus looked much too large, but a check of the entity characteristics showed that all the letters were the size specified to AUTOWORD. Usually you'd produce blocks of ext, then reposition and rescale automoved to the produce of the AUTOWORD place are text on Layer 0, AutoCAD's default a special characteristic of Layer 0 allows objects placed on it to

float to other layers on insertion. The only limitation to this design is AutoCAD's restriction on DXF files, which can be imported into a "drawing" only when the file is empty. A long comment block is probably added to a drawing far more often at the end of the drawing process than at the beginning. The solution is to create a dummy new drawing, read in the DXF file to produce AutoCAD text. and then save the file. You can then load this file into the main drawing and position it accurately, resize it, and so forth. This procedure is slightly cumbersome, but it's a small price to pay for the ability to use a word processor to create text blocks. Similar functions can be performed with Auto-CAD "Scripts. and perhaps AUTOWORD could produce this type of output as well as DXF files.

AUTOWORD's \$100 price is reasonable. An enhanced version selling for \$150 with improved tabulation capabilities and the ability to read comma- and field-delimited files is also available. Although many AutoCAD users may not need a product like AUTOWORD, hose who do large blocks of text or text tables will find that the program can quickly pay its way.





BILL OF MATERIALS REPORTING SYSTEM

The Bill of Materials Reporting System (BOMRS) from Sun-Flex is a general-purpose program that generates project management reports in conjunction with Auto-CAD. It has some interesting ideas but imposes rigid requirements on the attribute process.

Attributes (called tags by some systems) are descriptive text that becomes part of an entity. Usually used to attach data to such characteristics as part number. price, vendor, tolerance, color, and size, they are useful in such divergent fields as electronics board design, architecture, office layout, and more. Several microcomputer CAD programs, including AutoCAD

and CADVANCE, have attribute systems. The attribute data becomes part of the entity database and is thus an integral property of the entity. You can usually output the attribute information to a text file for manipulation by external programs. Auto-CAD, for example, can write its attribute data in two styles of ASCII text files for use by database managers like dBASE or high-level languages (as well as to a unique AutoCAD interchange format). Conversion to spreadsheet format is also possible, usually with extra steps.

Normally, you would use this extracted attribute data to prepare a bill of materials report collating all the items used in the drawing and calculating the inventory required and the cost. Similar reports can be useful in preparing price quotations for prospective jobs.

The main problem is the programming needed to manipulate the extracted attribute information. CAD users are not often serious business programmers capable of defining the necessary attributes or creating the reporting programs required. The result is frequently a call to a friendly neighborhood consultant. As with all custom programming projects, costs and time can be significant. On the other hand, the results will be tailored to your needs and will reflect the exact details of your business methods.

With BOMRS, on the other hand, you

create symbol blocks with only two attributes: part number and length. The "length" is actually any unit that indicates the cost of the item. The program can accommodate unit prices (as for a desk), cost per linear foot, per square foot, and more. A part number file is also constructed; it stores the part number itself and a description (30 characters), vendor name (only 10 characters), cost, list price, and an optional 20-character text field.

The symbols must be drawn in I by 1 blocks, as Autodesk suggests in Auto-CAD, to facilitate later scaling. Its actual size is determined with scaling commands when you insert the part into the drawing. BOMRS uses the scale factor to determine how much of the part to cost out. For example, if a foot of pipe costs \$1 and the block is inserted at a scale of 6 (for a 6-foot pipe), BOMRS looks up the part in the part number file and performs the simple multiolication to add \$6 to the bill of materials report or estimate.

The reports are simple (not surprising, given the limited number of data elements stored) but cleanly designed. BOMRS lets you mark up or discount the calculated costs, applying the revised cost to the total or to each part. You can add an estimated labor cost and estimated miscellaneous costs to estimate reports. You can then print reports or send them to disk files in

FACT

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or later.

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AUTOTXT TEXT CONVERSION PROGRAM

> AutoTXT Text Conversion Program from Micro Engineering Solutions is a program that offers text-to-AutoCAD conversion similar to that of AUTOWORD. Like AUTOWORD, AutoTXT reads ASCII files (but not WordStar document files) and creates files that can be read into AutoCAD for automatic text creation.

AutoTXT uses the AutoCAD Script method rather than the DXF format. The main advantage of this method is that it permits you to bring text into an active AutoCAD drawing at any time, rather than only when the drawing file is empty. You have to carefully specify character size if the imported text is to fit correctly, although you can always use the Change command to edit the new text. Alternatively, you import the text into an empty

"drawing" and later load it into the middle of another drawing.

formats suitable for dBASE II or 1-2-3, or in straight ASCII. Various commands edit and otherwise maintain the data files used in the system. The commands are straightforward, database-type instructions that

are easy to understand and use. BOMRS worked as advertised in my tests. However, building a symbol library with it is no more or less complicated than without it. The restriction of 1 by 1 symbol drawing is not burdensome, since this is the preferred method of building blocks anyway, and constructing the part number file is fairly simple as well. My main objection is BOMRS's fixed, inflexible database design. AutoCAD attribute definition and extraction and report generation simply aren't all that complex.

BOMRS is well designed and it works. but it's also not inexpensive. If the program's design is a close match for a situation you encounter frequently, consider it; otherwise, you may want to design your own version-by yourself or with the help of a consultant who knows your needs.

PC MAGAZINE . MARCHII. 1986

Requires: AutoCAD, 256K RAM, DOS 2.0

estimates and reports based on attribute infor-

mation embedded in AutoCAD drawings.

In Short: An inflexible, restrictive,

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SUPPORT

By adding a supplied menu file to the normal ACAD.MNU file, you can integrate AutoTXT into the AutoCAD environment. AutoTXT then can appear as an option in the AutoCAD on-screen menu. This technique lets you avoid leaving AutoCAD to create and import text files.

AutoTXT includes text features like variable height and spacing, justification, centering, font selection, and access to AutoCAD's overscore, underscore, and special symbols. You can also specify the layer on which the text will be placed.

However, AutoTXT has no provision for superscripts or subscripts, and its design limits line lengths to 80 characters instead of AUTOWORD's 255 characters. Also, its standard version has no table mechanism. A new AutoTXT release priced at \$150 adds tabular capabilities similar to AUTOWORD's.

PC Magazine Labs' tests of AutoTXT were uneventful. The program makes very different default choices (1-unit-high characters instead of .2-unit-high ones, for example), but once I made the specifications identical to AUTOWORD's, the end results were indistinguishable. Both programs took about the same amount of time to do their jobs with the sample files I used.

The choice between AutoTXT and AUTOWORD depends on your style and requirements. I much prefer AutoTXT's seamless integration into the normal Auto-CAD working environment, but AUTOWORD offers some extra features. Both programs work perfectly and have much to offer.



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CADILLAC ADVANCED

CADillac Advanced, from CAD Technologies, is a template system that resembles AE/CADD in some respects. It consists of a plastic sheet taped to a digitizing pad of at least 11 by 11 inches and a custom menu that you install into AutoCAD

Unlike the architect-oriented AE/ CADD, CADillac Advanced is a generalpurpose tool appropriate for any AutoCAD user. All the normal AutoCAD commands

CADillac Advanced completely replaces the standard AutoCAD screen menu system and achieves good results in

are available from the template, but many of them have been expanded with clever macros and other enhancements. In addition, CAD Technologies has included a number of new functions that AutoCAD lacks.

doing so.

In addition to an area devoted to screen digitizing, the tablet has 19 menu sections. Many of the menu boxes are devoted to issuing normal AutoCAD commands, and, as with any tablet system, choosing functions from the tablet can be much faster than navigating through the standard Auto-CAD on-screen menus. CADillac Advanced completely replaces the AutoCAD screen menu system, with good results.

CADillac Advanced places lines of three different widths, hatching, text, and dimensioning on separate layers and sets the display colors to differentiate among them. It uses far fewer layers than the 61 used by AE/CADD but makes meaningful distinctions nonetheless.

Among the plethora of new functions, several stand out. It has a system for creating two-point perspectives with vanishing

points for perspective drawing; dimensioning is simplified; and attractive tag symbols are available. Also, the program makes object snap much more convenient and adds inquiry commands. It allows you to draw lines tangent to two circles, rotate groups of entities, close gaps and square off corners with a clever Fillet macro, and insert polygons with up to 10 sides.

Other exciting additions include an excellent Limits system, which allows a drawing to fit standard plot sizes or to fit predefined scales much like the scaling system used in AE/CADD. The program can draw continuous curves, a feature lacking in AutoCAD that is here cleverly implemented with a macro invoking the Arc function with Continue. CADillac Advanced uses the variable and expressions functions included with the AutoCAD ADE-3 option to implement a powerful calculator. Square roots, logs, exponentiation, trig functions, various conversions, and more are available CADillac Advanced also includes a par

allel line system similar to AE/CADD's. The system can input exact dimensions for walls from a screen menu, insert openings for doors or windows, insert and automatically align a good selection of door shapes, trim wall edges, and so forth.

CAD Technologies includes instructions for modifying the system for use on large digitizer tablets. While large tablets

are most often used for tracing existing art into AutoCAD, the big tablets can actually be less convenient for entering new drawings. Adapting CADillac Advanced to such pads can give you the benefits of the package while still allowing a large digitizing area.

An optional program called CADillac Custom modifies the CADillac Advanced template. You can add your own symbols to the system with an on-screen menu for selection, incorporate up to 21 user-defined macros, and change or replace many of the program's options. CAD Technologies also sells a simpler version of CADillac Advanced for users of AutoCAD Version 2.0

CADillac Advanced is suitable for almost any AutoCAD user. Architects might find AE/CADD's huge block and shape libraries and specialized functions worth the extra cost, but for most users CADillac Advanced is the program of choice. It is simply superb. CADillac Advanced can reduce learning time and improve productivity.

AUTOSHAPES

Shapes are special AutoCAD entities, resembling blocks. They can consist only of lines, arcs, and circles and are gathered into libraries or collections. The Shapes mechanism allows you to generate both geometric shapes and text fonts. With AutoCAD, however, this process is highly

complex and time-consuming. AutoSHAPES, from Systems Unlimited of California, is an elegant utility that allows almost any AutoCAD user to gain the benefits of AutoCAD's Shapes system. It simplifies both the custom text font generation and drawing uses of the Shapes fa-

AutoSHAPES supplies prototype drawings for both text and drawing shapes. It displays a 16 by 16 matrix of boxes, one for each of the codes in the ASCII character set. From the screen menus you select the exact box to work with, which then automatically zooms to fill the screen. You draw the shape within the box using a 100 by 100 grid. When you insert the shape





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In Short: A powerful template system that makes AutoCAD operation much faster, adds a slew of advanced, useful features OFFICIE 664 ON READER SERVICE CARD

into a drawing, the scale factors will determine its actual size.

You give drawing shapes names that will be used when the shapes are inserted into a drawing. Text character shapes use the ASCII value you select, so that a character drawn into box 65 would be used in-care drawn into box 65 would be used in-care flavon into box 65 would be used in the contract of the

Once you've defined the shapes, Auto-CAD produces a DNF file, Aum/GHAPES processes this file and produces a shape file, which AunoCAD then compiles into a usable shape library. This process is somewhat cumbersome, relying on the structure of the Autoels's shape mechanism. Actually, everything proceeds with reasonable dispatch if you follow the steps correctly.

Î designed a half-dozen custom symbols in only a few minates. While the restrictions AutoCAD places on the entities that you can include in shapes are a bit annoying, the AutoSHAPES part of the shape design process could scarcely be any easier. Defining text fonts is a more tedious process, but AutoSHAPES makes it much easier than it would be with AutoCAD alone.

The AutoSHAPES developers have in-

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AutoSHAPES

cluded an attractive outlined Helvetica text font they created using the program. A monospaced font called Fsimplex is sold separately. This font resembles the standard AutoCAD Simplex font, but it's not

proportionally spaced. Without proportional spacing, normal text is less attractive, but this font is perfect for tables and other columnar text. A selection of mathematical and Greek symbols is included.



In Short: A unlify to create Auto/A/D shapes; generates both geometric and text font shapes; greatly eases the complex procedures required to gain the speed and disk storage advantages of the Shapes system.

CIPCLE 665 ON FEADER SERVICE CAPO

Requires: AutoCAD.



Used like any other AutoCAD font, the Fsimplex font works as advertised. If you drawa lot of tables or need the special symbols it offers, it may be worth the \$150.

AutoSHAPES itself is definitely worth its price to AutoCAD users who need a large number of symbols and other predefined entities.

INSIDE AUTOCAD

One criticism leveled against AutoCAD is the difficulty new users have in assimilating its large number of commands. Inside AutoCAD is a lengthy, well-produced tutorial book that takes new AutoCAD users by the hand and leads them through the program's maze of powerful techniques.

Inside AutoCAD goes beyond merely explaining the mundane details of Auto-CAD use. It does a terrific job of teaching a new AutoCAD user a workable and efficient style that will pay dividends in realworld use.

For example, the book covers object snap very early, when discussing basic AutoCAD tools. Many AutoCAD users have worked with the program for a long time without learning to get the most from object snap. Similarly, the book includes useful suggestions on using layers, limits, and units before even explaining how to draw much of anything. Clear diagrams help beginners navigate through the sometimes intricate AutoCAD on-screen menu structure. Step-by-step tutorials walk you through complex operations. The book's writing style is clear and

light, although some of the attempts at humor are a bit strained. The large page size allows airy layouts, but the binding makes it difficult to use the book alongside the computer; a ring binding would be less elegant but perhaps more usable.

The book's coverage of blocks, plotting, dimensioning, and attributes is especially good. The authors distinguish between graphics intelligence (dimensions) and nongraphics intelligence (attributes)a clever way of looking at these subsystems. Scripts and macros are well covered.

The book does not cover several Auto-CAD features, including shapes and the 3-D features of the ADE-3 package. A much more important omission is polylines. The book mentions this entity and its editing subsystems only in passing and does not explain its use at all. Many common drawing situations require polylines, so the book's lack of coverage is a significant weak point. Since polylines are admittedly

CAD, this makes the help the book provides in other areas even more necessary. Nonetheless, Inside AutoCAD is generally a first-rate effort. It will definitely help beginners gain AutoCAD proficiency more quickly than the AutoCAD documentation

one of the more difficult issues in Auto-

■ Inside AutoCAD will definitely help beginners gain AutoCAD proficiency much faster

than the AutoCAD documentation alone.

alone. If you lack time and access to a personal instructor, Inside AutoCAD can help tremendously.



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etter written and more acce the AutoCAD manual; well worth the price even though it doesn't cover all aspects of AutoCAD

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AUTOLISP

Autodesk is now putting the finishing touches on an actual LISP language that will be embedded within AutoCAD. The implementation of LISP for AutoCAD will be called AutoLISP, which I tested in the beta version. This development should be quite interesting to advanced CAD users.

The current version of AutoCAD with the ADE-3 extension package includes features called variables and expressions. These functions allow the program to define integer, real, point, and string variables with values you supply. You can use such variables whenever AutoCAD requests data, and you can perform some simple arithmetic, string, and conditional operations on them with the program

On the surface these features seem limited and not terribly useful. In reality, however, you can build surprisingly powerful tools from these simple building blocks. For example, many of the special functions provided with AE/CADD and CADillac Advanced use variables and expressions to great advantage.

The somewhat odd syntax used in manipulating variables is explained by the fact that they derive from the LISP highlevel language. LISP is a list-processingoriented language favored in artificial intelligence applications, for which manipulating lists is critical.

At first, LISP seemed to me a rather odd choice to use with AutoCAD. I discussed the new AutoLISP with John Walker, president of Autodesk, who explained that most CAD systems-micro, mini, or mainframe-invent their own idiosyncratic macro languages when they want to add programmability. Autodesk wanted to stay with an established language instead. The company considered languages like BA-SIC, C, and Pascal, but it wanted a highly interactive environment that could handle the variable-sized sets of objects appropriate for CAD. LISP turned out to be perfect. Autodesk also found it could implement a meaningful subset of full LISP reasonably compactly-a significant issue in the tight memory constraints imposed by the complex AutoCAD environment. The purpose of including a high-level language within AutoCAD is to allow the user to define new functions to add to the program. The goal is to allow sophisticated users to do anything Autodesk itself could do in adding to and/or customizing the program.

une program.

Autodes ab believes strongly in the Autodes Autodes of the Autodes Autodes of the Autodes Autode

While I am a professional programmer in dBASE and BASIC and have written in FORTRAN. Pascal, and some C, LISP is not an arrow in my quirer. Therefore, I don't pretend to be capable of fally execusing the beta version of AutoLISP that Autodesk sent me. If anything, I might confess a slight bias against the language based on the few magazine articles I have read. The heavy parenthesis nesting and strange terminologies; always out me and.

Using AutoLISP for a while proved surprisingly enjoyable, however. As advertised, the language makes manipulating groups of objects a snap. It is just what the doctor ordered for a CAD system, in which managing a list of point coordinates

is the norm. LISP's highly interactive nature makes if cel almost like API. in its direct connection between the user, the guage, and, in this case, AunoCAD itself. I amount and LISP's strangeness even proportion quickly and that the different thought processes necessary to work with a list soon felt quite comfortable. I was able to construct a few useful LISP functions; a real LISP programmer who also knew Auso-CAD could have a field day.

The real significance of an AutoLISP implementation is that it offers serious software developers the potential to take the variables and expressions features to new heights. I spoke with some third-party developers who raved about the powerful

■ With AutoLISP, LISP's strangeness evaporated quickly, and the thought processes necessary to work with a list soon felt quite comfortable.

capabilities they have begun to add to their

products. A fascinating memo from Autodesk president John Walker is included with the beta version of AutoLISP, discussing where Autodesk hopes to go with LISP. The version of AutoLISP that will be released soon is a step along a continuum that the ADE-3 package started. The most important attribute the initial AutoLISP will lack is access to the graphics database that comprises the AutoCAD drawing. Even without this access, though, Auto-LISP supports lists, symbols, strings, reals, integers, file pointers, and subroutines-a wide range of operations. Many dialects of LISP exist, but AutoLISP conforms most closely with the Common LISP version. While it is a small subset, it does play by LISP's rules and so consulting LISP texts is profitable in learning Autol ISP

My AutoLISP experiments clearly indicated that Autocleak has made an interesting and valid choice for expanding AutoCAD's horizons. I've already ordered of advanced AutocAD users and software developers will oble same when AutocAD users will benefit from this enhancement through the availability of more-powerful support software.

AUTOCOGO

An indication of the power that even the basic variable and expression system offers is a new program called AutoCOGO from AVE Micro Systems. Surveyors and civil engineers use COGO (coordinate geometry) programs to lay out subdivisions and other projects.

and other projects.

These programs take input from field surveyors and perform a variety of calculations to locate buildings, size loss, and more. Sometimes the resulting nameric data as a suitable for tend Comppers, and one of AE's previous products was an interface between some popular more OOGO programs and Auto-AD that almost you believe to the project of the

AutoCOGO is the first interactive COGO. It is not an interface. AutoCOGO operates within the AutoCAD environ-



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SUPPORT

ment, performing many traditional COGO functions and displaying the results immediately while offering the many benefits of AutoCAD as well.

AutoCOGO lets you set or locate points; set points by azimuths, bearing, or angles: number entities automatically or manually, set or locate points; calculate intersections; divide lines and curves into any number of segments; design curves; and more. It also offers various automatic line notations. Special commands allow you to save and retrieve point and curve information in random access files and in

ASCII form. The current AutoCOGO Level 1 version takes advantage of only the variables and expressions features of AutoCAD ADE-3. A custom screen menu structure helps you use the program, and an even handier template is available. The current menu system is encrypted because most of the functionality is included in the menu file and circulating it uncoded would reveal the program's tricks and techniques to the competition. The encryption prevents you from merging the menu into existing menus, reducing the program's flexibility somewhat

A/E is now rewriting AutoCOGO in AutoLISP, which will give it significantly faster execution, more features, and unencrypted menus. A/E also plans to offer another Level 2 AutoCOGO module, which will add spiral curves, horizontal and vertical alignments, adjustment of areas, traverse adjustment, field stakeout, and more. Level I and Level 2 are available at

a cost of \$500 each. A surveyor client of mine reports that even the current Level I AutoCOGO is a tremendous timesaver. He previously used a freestanding COGO package and A/E's interface to AutoCAD, but the new interactive program is much more intuitive and faster than the batch-oriented method required before.

AutoCOGO is a perfect example of the benefits of Autodesk's open-architecture policy. A/E Micro Systems has a good reputation for developing AutoCAD-compatible software. Its current AutoCOGO implementation is a fine product, but what's coming down the road should be even more impressive.

AUTOCAD DRAWING EXERCISE

The AutoCAD Drawing Exercise, from Autodesk itself, is a step-by-step exercise designed to be what Autodesk calls "a basic training tool," It claims that the book "should significantly reduce the time required to learn AutoCAD.*

Well, the exercise doesn't help very much. The 160 or so pages walk you through creating a complex drawing, using several of the more impressive AutoCAD facilities along the way. Unfortunately, for the most part, the tutorial either gives no explanation of what is going on in the exercise, or presents a sketchy, inadequate exposition. Most of the action consists of merely following the detailed instruction to pick this or that menu item or to draw this or that entity precisely per the book's

If you're perceptive, you'll learn something from the several hours it will take to complete the drawing. This activity has some value, but the project would have been so much more helpful if someone with professional programmed-instruction expertise had been involved in its develop-

Potential and beginning AutoCAD users need good tutorials, perhaps keyed to its various vertical market segments. The AutoCAD Drawing Exercise is a step in the right direction, but Autodesk can surely do better than this



Autodesk Inc. 2320 Marinship Way Sausalino, CA 94965 (415) 332-2344 List Price: \$25 In Short: A useful, but flawed, AutoCAD tutorial CIPICLE MED ON READER SERVICE CARD

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ADATABASE

magine, if you will, that you are the microsystems manager for your company. You select the hardware, software, and related systeems. You have selected the database management software after careful analysis of your company's needs and have become thoroughty proficient in its query language. You are so good at the query language that you can even extract information from the personnel department.

You're at the center of all the action. You have canned a few reports for the boss, but when he wants to play "what-if" with the database, you're needed, right there at his side. After all, you are the query laneuage mogul.

At first, you feel indispensable; you like it that way. But soon the novely wears off. The boss likes to "think" at six on workday mornings and even comes in weekends to play with his information collections. Playing what-if requires a thorough knowledge of a database query language, and the boss just isn't set up internally to learn one. So, when he's there, you're there.

The solution is an "intelligent" software pack-

WITH A SMART INTERFACE

Learning a database query language can be a daunting chore, but with Q&A, a database with an ''intelligent'' interface, you can place the burden of learning on the program.





Once Q&A has parsed your plain English query into its internal command language, the program asks if what it thinks you want is really what you want (left). An affirmative response signals it to produce a report (right) in answer to your query.

age; one that includes a query language for you and a smart front-end for the boss. But "intelligent" in this case would have to mean more than the ability to handle macros. The system would have to be able to "relate" to the boss in the California sense, and it would have to "do better with each session.

The answer to this software challenge-at least for some microsystem managers and their bosses-is Symantec Corp.'s O&A. O&A comprises menudriven, integrated word processing and database functions (nothing special there) and adds to that a smart query language that gets even smarter as time passes. That's pretty special.

According to Q&A designer Bret Walter, the concept behind the program was to marry two commonly desired and closely related functions-word processing and data management-into a single package that had a high degree of functionality and synergy.

WORD PROCESSING O&A's word processor, Write, is memory dependent. A computer system with 512K bytes of RAM can handle an 80K-byte (36-page) document. It has most of the features of intermediate word processors, including block operations, wildcard searches and swaps, special character handling including subscript and superscript, and file management. It makes full use of arrow keys for cursor positioning and function keys for word processing services. Brief prompts are displayed at the bottom of the word processing screen, and full on-line help is always available by pressing F1. The system offers few bells and whis-

tles for the professional writer, but then O&A is designed for the business writer rather than the professional. It does provide numerous nice-to-have business features, including the ability to draw lines and boxes, and both on-screen math and /-2-3 import capabilities. An 80,000-word spelling checker, integrated with the word processor but not the database, was scheduled for release in January, and is free to registered users.

The strongest feature of Write, as you might imagine, is its close integration with the O&A database facility. It can accomplish mail-merge-type functions, for example, with a single keystroke and can import and export information from the database files with similar ease.

DATABASE FACILITIES Q&A's database facility is aptly named File. Each database is contained in a flat file, and only one database file can be accessed at a time. (In other words, this is not a relational da-

tabase.) The O&A database facility is intentionally structured along the lines of PFS:FILE and IBM's Filing Assistant. In fact, its user interface is an unabashed copy of that of PFS:FILE and Filing Assistant. At first the single-table limitation would seem a significant drawback, but according to the company, market research indicated that a

single flat file is sufficient for 80 percent of all business applications.

O&A enables you to create as many different flat files as you need, to cover all aspects of your business. Like PFS:FILE and the Filing Assistant, O&A uses the "form" approach to database development and presentation

In practice, the O&A word processor is used to develop an I/O form for the data file. This form defines all fields and assigns data types to those fields. Data types include text, number, money, logical, date, time, and keyword (as in classification as opposed to index).

O&A comes with a miniprogramming language that allows you to define one



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drives In Short: An integrated word processor/ database manager with an intelligent query CIRCLE 666 ON READER SERVICE CAR

field in terms of the values in others and to create I/O range and logic checks.

In any event, once a form is defined, it, in turn, defines a related data table and index table. Those two tables (files) and related forms comprise a database. Forms are also used to generate reports more sophisticated than simple data lists.

If Symantec had stopped right here it would have ended up with a product similar in form and function to the PFS:WRITE/FILE or IBM Writing/Filing Assistant combinations. And, indeed, it might have been a successful third wheel in this class because its database manager is more powerful than the others and the word processor is faster when checked with industry standard benchmarks.

THE HEART OF THE MATTER Symantee didn't stop with the word processor and data manager. At the heart of the O&A system is the Intelligent Assistant. Symantec hired artificial intelligence expert Gary Hendricks to provide end users with a smart interface to the database. Q&A is delivered with a 400-word vocabulary and a utility that enables you to "teach" the Intelligent Assistant all about a given data-

Once a database is defined (using a form) and loaded (using forms or importing data in ASCII, .DIF, or .WKS), it's time to teach the Intelligent Assistant about the database. The general lessons include the following:

base.

- · What this database is about. -
- Which fields identify a form. Which fields contain locations.
- · Which fields contain people's names
- Alternative field names.
- · Units of measure
- Advanced vocabulary—adjectives. Advanced vocabulary—verbs.

For example, suppose you are working on an employee database that contains the usual data elements of name, address, sex, hobbies, department, salary, and so forth. A personnel database is about employees, workers, persons, people, slaves, or whatever you want to call them.

Lessons on fields are similar. The address field, for example, could refer to home, house, pad, abode, hideout, or cave.

Once you describe your database to the Intelligent Assistant, it's ready to go to work for you. For this report, I drafted a coworker to help. She works with PFS:FILE daily in an educational placement environment. We began by asking the program some simple questions, which we

ministration?"

Ese-Cancel F3-Belete synony typed in at a prompt: "Who works in ad-

If O&A doesn't understand a word in your query, you can teach it to recognize the new word as a synonym for a word it does know.

"I ist the total sala. ries for the sales department." Q&A handled these questions without

further prompting. It's interesting to watch Q&A at work. Once you type in your request, it is parsed by the system. Individual words are highlighted as the system scans the query sentence and attempts to put the request in context. When it "thinks" it knows what you want, O&A requests verification. For

example, after parsing and digesting the

to create a report showing": "The full name, department, employee ID number; from the forms on which department equals administration?" Our affirmative response enabled the

system to generate the correct listing. A more complex request-"List the girls who went to Harvard and like reading? required some additional instruction to the system. (Our apologies for using girls. We did it intentionally because the system alfirst request. O&A asks:"Do you want me ready understood women and ladies.)

O & A: Features and Performance Maximum records per database* 16,000,000 Maximum database file size 256 megabytes Maximum record size 16,780 bytes Maximum fields per record 2.400 Maximum label formats per file unlimited Maximum number of index fields per database 115 Maximum fields per page 240 Databases open at once Data types (seven) text, number, money, logical, date, time, key word Precision of number type 15 significant digits Sort levels 50 Break levels 16 *Database is a single file or table



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■ A SMART DATABASE

TEACHING Q&A ABOUT GIRLS As Q&A parsed the query, it halted on the word girls and asked if we wanted to skip the word or teach it about girls. Often skipping garbage words is enough, but in fore see girls was an important descriptor, so we opted to teach the system what it needed to know about girls.

Following the prompts, we elected to teach Q&A that girls was a synonym for femule, which Q&A already knew was a possible data element in the field "sex."

p. To quasile with a figured out that "like cading," referred to the possibility that "reading," was among the strings to be found in the "hobby" field. It then asked the confirming question. "Do you want no to create a report showing: The full name, department, employee ID number; from the forms on which sex equals female and hobbies equals reading and alma mater equals Harvard.

We responded affirmatively and the report was generated. Actually, we spent several hours playing with the employee database (supplied on-disk) and the intelligent query system.

I suppose you could debate for hours exactly what "intelligence" means in a software system. However, I think it is fair to call Q&A intelligent based on the fol-

lowing observations.
First, Q&A puncs a request and attempts to understand it based on its own occabulary and its past experience. If it can't understand a word or phrase, it ask for more information from you until both system and you agree that the intent is clear. After it delivers the requested report, it remembers the discussion so that the next time similar phrasing and vocabulary are used it will not have to ask for clarification.

Basically, this mimics the conversation of database software technician and his or her boss would have when defining a what-if query. So, Q&A meets the test of "intelligence." (Would that everybody took the time to make sure he or she understood e situation before bursting into action.)

I used a PC AT for this review. The parsing and retrieval speeds were entirely satisfactory. However, another reviewer at PC Magazine tried Q&A on a plain PC with two flooppy drives and reports that

data retrieval was "sloooooow—a clear loser in the Hunt's versus Heinz ketchup contest."

PLAYING WHAT-IF WITH QAN. Durelyind scenario had microsystem manager giving up weckends so he could come to work and help his "Query language lili-crate" loss play what-if with the corporate database. Iz QAS smart enough to stand in for the microsystems specialist on the weckends? Can the untrained box sensuly sid down and have a meaningful discussion with his database management software?

Our experiments certainly support that view. In our exceptioners, we saked OAA.

conversation a database software technician and his boss would have when defining a "what-if" query.

Q&A mimics the

all the permutations and combinations of employee data we could think of, including several questions involving calculations. Our "conversations" with Q&A averaged less than a minute per query.

enged tess than a minute per query.

I mentioned earlier that Q&A was intentionally designed with PFS-FILE and
BMF Filing Assistant in mind. Not only
did the designers of Q&A go for the simplicity of those carlier systems but, pragmatically, it built into Q&A full support for
lifes originally created under those popular
systems. Q&A's import utility will digest
tiles created by either of these odder data
managers including forms and reports with
no user intout they than file ranges.

For the 80 percent of data management tasks that can survive in the world of flat files, Q&A seems to provide a uniquely functional answer. Its designers have done well.

Richard Aarons is a contributing editor of PC Magazine.

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of AutoCAD

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between Autodesk and its customers is accomplished via "The Final Draft," a quarterly newsletter for licensed AutoCAD users, and by participation in user sessions scheduled during major conferences where AutoCAD users and

Regular communication

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RING I A N.

THE

True, IBM's new token-ring network has established usseful networking standards, causing other companies to rush products out to get a piece of the LAN market. But is it wise to invest in a LAN now? Read on.

Some : A Washington cocktail party. One of us was munching caviar on a Triscuit. A young Capablo Hill aide sidded up to him. "Well, what impact do you think IBM's token-ring will have on the networked applications market?" she saked. He coughed fish eggs into a napkin and sputtered for a reply. Finally, he said something that must have been sufficiently noncommittal. She nodded vaguely and wandered off after more Perieric. Later. we

nore rerner. Later, we reflected that if IBM's announcement of its token-ring network has broken through to the insulated parfors of Georgetown, it must be echoing down the streets of towns where PCs are used for profit instead of politics.

The congressional aide's question had a lot of merit. As most of you are aware of by now, IBM has turned the local area network marketplace on its ear by introducing the token-ring network, a seemingly strategic product for the company. But very few people could make cocktail-party conversation about what a token-ring really is

and why it's so important as a new product—until now. Read on: You'll be ready to drop words about the IEEE 802.5 and lost tokens while negotiating for a position around the punch bowl. Or, perhaps more important, you'll get some insight into why you should or should not invest in a corporate local area network (LAN) right away.

APPLICATIONS COUNT: Actually, the IBM token-ring network affects most percent only as it relates to applications software to the country of t

Yes, others counter, you can transfer files or share a printer efficiently for much less cost and bother than installing and operating a LAN. But using a LAN to allow programs running on distributed systems to get at data being shared or stored in a central place is a good reason to expend the



What? Why? Now?



The IBM token-ring LAN works differently from other networks. It circulates a special message, or token, that gives a station permission to transmit.

required money and effort.

If your best justification for establishing a LAN is to be able to share files simultaneously, the applications software you plan to use becomes critical. This software has to do all the things you want it to do; it must also work with the networking software to regulate the simultaneous accesses made to files. All these considerations are separate from the configuration of the wiring in the network or the method the systems use to put information on the wire.

SETTING STANDARDS The first important thing to know about the IBM to-ken-ring system is that the big news was made before IBM announced the token-ring. In March 1985, IBM and Microsoft set a new standard for network operating systems and software when they released MS-DOS and PC-DOS 3.1. These two products, slightly different in configuration, include file- and record-locking features that became standards overnight.

unes hare ecame stancators overnight. Defeore the related to the SPD/S and PC—
Before the related to the SPD/S and PC—
sevent different methods of signaling and
sevent different methods of signaling and
controlling file and record locking. The
variety of standards meant that a
networked applications program file a datubase manager could allow file sharing
under some network operating systems but
not under others. Programmers are now
under some network operating systems
but not under others. Programmers are
now the programmers are now
the standard of the standard of

or they are licensing MSNet software modules directly from Microsoft.

So the big news, actually the IBM/Microsoft action that set the standards for the interface between network operating systems and applications software, makes all LANs more practical. But its impact won't

IBM and Microsoft set a new standard for network operating systems with DOS 3.1.

be seen for months, until the applications programmers catch up.

Meanwhite, all the talk is about tokenrings. Companies are clamoring to tell you how their new products are compatible with or better than the IBM token-ring. 3Com Corp., Novell Inc., Nestar Systems Inc., Ungermann-Bass Inc., Protocol Inc., Corvus Systems Inc., and Bridge Comminications Inc. annunced new tokeninciatons Inc. annunced new tokentications Inc. annunced new tokenciatons Inc. annunced new tokenticatons Inc. annunced new token-

THEORY AND REALITY Stations on a LAN can be physically hooked together in different ways. They can be connected to a main cable run like leaves hanging off the

branch of a tree, hooked to one central point like the rays of a star, or linked in a ring. The method of connection is called the topology, and the ring topology is the one chosen by IBM for its major network offering.

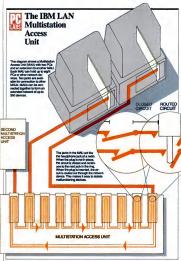
The phrase token-ring evokes a picture of a shining coin racing around a ring of gold. In practice, however, the ring has been squashed in the middle into something called a star-ring network.

IBM ushered in DOS 3.1 in a product it called PC Network. PC Network uses a tree branch or bus topology. This difference points up the second important thing to remember about IBM's announcement of the token-ring: The token-ring is totally different from the PC Network, but to anyone using the terminals, they may look the same. The two systems can be interconnected, but only by a dedicated PC-XT or AT (obviously not an inexpensive network interconnection device) running special software and containing two different network adapter cards. But because certain modules of the network operating system are the same on both the token-ring and the PC Network, applications should run on either network.

THE TOKEN Connecting the distributed ed systems is only a small part of the ed systems is only a small part of the pollent in designing a LAN. The stations on the network also must be able to share the econoccing wires in some way so that the connecting wires in some way so that the messages they seed don't interfer. The method of sharing the wire is known as the excess protocols are commonly used, but up until mow, the most common type was a system known as Carrier Sense Multiple Access, or CSMA.

The CSMA protocol works like a citizens band or police radio. Stations listen for a clear channel before they transmit and address messages to each other. Ethernet, StarLAN, and nearly all networks for the PC developed up to this time use CSMA.

The IBM PC Network also uses CSMA, but the token-ring network runs very differently: It works by circulating a special message, or token, giving a station permission to transmit. So the word token in the phrase token-ring network is key, referring to a very different access protocol than used normally for the P.



THE TWIST The phrase token-ring leaves out an important part of the system's characteristics: the wiring or media. The IBM system should be called the token-ring twisted-pair network. That points up another item of news about the IBM announcement: Big Blue seems to have backed away from its love affair with relatively expensive coaxial cable and moved toward the less-expensive twisted-pair wiring. In smaller installations, this type of | market is the availability of a low-cost in-

wiring, the kind installed for telephone systems, will probably work very well for moving IBM's tokens on their rounds. Since the beginning of recorded histo-

ry, scientific standards have been necessary to allow for the exchange of information and promote commerce. Today, new communications standards must be based on processing speed and switching time. The key to the development of the LAN

terface. The cost to connect equipment to a LAN must be much less than the cost of the equipment alone or of other alternatives like direct RS-232C cabling. The requirement for low cost plus the complexity of the LAN protocols dictates a solution using VLSI chips. Chip manufacturers are reluctant, however, to commit their resources to making these chips unless they see a high-volume market. LAN standards assure that the volume will exist and also that equipment from a variety of manufacturers will be able to communicate.

The Institute of Electrical and Electronic Engineers (IEEE) established committee 802 to develop standards for local area networks. Years of work by the committee and various subcommittees made up of people with many different corporate

axes to grind produced three basic standards. Two of these standards are for the bus or tree branch topology popularized by systems like Ethernet. Most of the interest within the committee was focused on these bus-type LANs. IBM, on the basis of extensive

research, was virtually the only participant interested in a ring-type LAN. The final IEEE standard for the ring, IEEE 802.5, is largely an IBM creation. At the same time, IBM set identical LAN standards into place within the structure of the European Computer Manufacturer's Association

The double lock, in effect, that IBM set on the standards means that its token-ring network is likely to continue to be a major product in the marketplace. Not only does the token-ring network have the IBM name, but it also has the legitimacy of being both a national and an international standard. Establishment of the multiple standard apparently nurtured the faith of the semiconductor companies. Texas Instruments is leading a pack of companies that are selling relatively inexpensive chip sets like the TMS 380, able to perform all the 802.5 functions

The open drive by IBM to develop the IEEE 802.5 token-ring standard was noticed in other places as well. It explains the reserved reception that the earlier CSMA/ bus/coax PC Network received. Everyone who read the literature realized that IBM had something else in mind.



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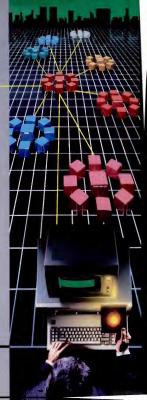
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TOKEN-RING SPECIFICATION The IEEE 802.5 standard defined the characteristics and operation of a LAN with a ring topology. According to the standard, a ring consists of a closed loop of repeaters. Data circulates around the ring in one direction. Each repeater echoes the incoming bits, one at a time, on the outgoing link

The token-ring access technique is based on the use of a single token that circulates around the ring when all stations are idle. A station with a message to transmit waits until it detects a token passing by. It then changes the token from a "free" token to a "busy" token. The sta-



contoins a microprocessor operating under the control of resident ROM software.

The Multistation

Access Unit is designed to make it easy to move equipment around while

keeping the ring intact.

tion transmits a block of data called a frame immediately following the busy token. The frame contains all or part of the message the station has to send.

Once a station transmits a frame, there's no free token on the ring, and so other stations wishing to transmit must wait. The frame on the ring will make a complete roundtrip and be purged by the transmitting station. The transmitting station will insert a new free token on the ring when it has finished transmitting its frame and the busy token has returned. The token system guarantees that only one station at a time can transmit.

Since errors may occur for many reasons, the IEEE standard provides for situations where no token is circulating or where a busy token circulates constantly. These situations are taken care of by designating one station on the network as the active token monitor.

The monitor detects the lost-token condition by using a time-out greater than the longest time required to traverse the ring completely. To recover, the monitor purges the ring of any residual data and issues a free token. To detect a circulating busy token, the monitor sets a specified bit to I on any passing busy token. If it sees a busy token with the bit already set, it knows that the transmitting station failed to purge its frame. The monitor then changes the busy token to a free token

Other stations on the ring have the job of being a passive monitor. Their primary function is to detect failure of the active monitor and in that case to assume its role. A contention resolution algorithm is used as a mathematical referee to determine which station takes over

IBM'S IMPLEMENTATION IBM's token-ring network closely follows the IEEE 802.5 standard, but IBM has added additional features to improve the reliability and ease of installation of the product.

If you look at a token-ring installation, you may think someone goofed. Physically, it doesn't look like a ring with wires going from machine to machine, but it rather looks like a star topology with cables going from each machine to a central connection point that IBM calls a Multistation Access

The Multistation Access Unit is designed to make it easy to move equipment around while keeping the ring intact. Inside this unit the ring connection is assured, but each computer or terminal has only one multiconductor cable going to the Multistation Access Unit.

The Multistation Access Unit allows the wiring of the data network to be much like that of a telephone network. Two twisted-pair wires connect each terminal to

the Access Unit. The Access Units can be connected to form a larger ring. The IBM token-ring network Multistation Access Unit has connection points that allow up to eight PCs or other devices to gain access to the network. The Access Unit can be placed in a 19-inch rack or in a special cabinet for mounting on a desk or wall.

This ring, which looks like a star, is often called the star-ring topology. It has been described in IBM literature for several years, but the first hardware like it on the market from a major vendor was the Star-

LAN system from AT&T.

STRENGTHS AND WEAKNESSES The token-ring LAN has many strong points. IBM has carefully tried to anticipate and resolve all limitations or problems of this approach. You have to look hard for theoretical or practical criticisms.

A token-ring system has a number of advantages over bus-based approaches. The IEEE 802 committee determined that the token-ring access method provides the best throughput under heavy load. Remember, IBM still thinks it makes its monev selling big computing iron. Its vision of the future shows heavy data traffic moving efficiently through big pipes to big processors. The LAN must be a gateway, not a roadblock.

A second advantage is that the electronic package required to connect to a ring LAN is simpler than that required to connect to a bus LAN. The ring consists of a set of point-to-point links. In a bus system. multiple transmitters and receivers hook to a common media. Problems such as tan insertion loss and unbalanced signal strength

IBM TOKEN-RING LAN PRODUCTS

Get'em while they're hot. IBM is offering quantity discounts for multiples of 8 and 20 station systems on its token-ring network.

controller.

I BM announced the products that make up its token-ring network on October 15, 1985, but did not promise most of the network components until "the first quarter of 1986." What the token-ring pieces will look like and how the competition will react are still up for speculation for the most part.

PRODUCTS PC Adapter and software The PC Adapter and fish into one long expansion slot on a PC. It contains a microprocessor flat operates under control of resident ROM software. It control of resident ROM software with the card, you get a disk with the network. All properties of 2005. All disposits software and present and recoverable error conditions are determed and information on the probable source of the error is presented."

une tito's presented.

Multistation Access Unit (MAU): The MAU looks like little more than a strip of connection jacks. Insertling a plug into the jack breaks the ring and routes connection for the plug into the jack breaks the ring and routes connection from the ring can be restored and problems isolated by unplugging terminals until the bad one found. The MAU can connect up to eight PCs or other devices to the network. Larger networks are constructed by connecting MAUs. A single MAU retails for 5600.

Asynchronous Communications Server: The ability to dial into a network and use its resources can be very useful. This \$495 software product allows a networked PC to serve as a gateway for telephone modem access to the network.

IBM Token-Ring/IBM PC Network Interconnect Program: Those who jumped into the PC Network environment might want a way to communicate with the radically different token-ring world. This program, with a retail price of \$495, requires the use of a dedicated XT or AT to serve as a communications bridge be-

tween the two types of IBM networks.

IBM SNA 3270 Emulation Program:
This program gives the network access to
an IBM mainframe by causing one station
on the network to act as a 3274 cluster

IBM Series/1 Gateway: Another way to get into the environment of IBM SNA communications is by using an IBM Series/1 minicomputer as a communication controller. The Series/1 Gateway consists of software and an adapter card for PC-to-

Series/I communications.

APPC/PC: The Advanced Programto-Program protocol software is a development tool for programmers. Applications programs written using these
protocols automatically exchange data

■ The PC Adapter Card fits into one long

expansion slot on the PC.

with programs running on IBM mainframe systems. This set of protocols will allow truly transparent micro-to-mainframe communications. The \$150 APPC/PC package will be available in the second quarter of 1986.

PRICE COMPETITION IBM says that quantity discounts will be available for multiples of 8 and 20 systems. A network with 8 stations would cost \$528 per workstation, excluding the PCs and case the toget declivery of the Texas Instruments chips. If competing vendors are able to get declivery of the Texas Instruments chips est and If IBM keeps its word about making network specifications open to other vendors, it seems evident that IBM will face stiff competition on price and integration of functions.

The prototype version of the IBM network adapter card had lots of room to be sepeczed in size. Competing vendors will certainly integrate a network adapter with 10,0 or other functions. A caute combining the network adapter with a modern and some kind of asynchronous interconnection software sounds like a pretty good product. An aggressive company could bring out such a product for less than IBM's price for the YC Adapter Card IBM's price for the YC Adapter Card

atone.

Similarly, the price of the MAU can certainly be reduced, and a smaller MAU (perhaps for four stations) combined with a network adapter would seem to be a worthwhile product.

UNIVERSAL SOFTWARE In November, Novell announced that IBM had purchased marketing rights for Novell's Advanced Netware. It isn't clear that IBM will use Netware for the token-ring, but it seems likely. This action would open the way to a really universal communications interface for local area networks.

COMPETITION MEANS CONNEC-TIONS Notice all the micro-to-mainframe products designed for the tokenring LAN. Mainframe products have high profit margins, and IBM still has a hammerlock on that market. Five or ten PCs working into a mainframe through a network can mean the sale of a lot of mainframe hardware and software. You may use less expensive token-ring LANs to move data and PC clones to display it, but in the end, IBM knows where the major portion of the information will reside and be processed. If you postulate an overarching strategy for IBM, you'd have to say that every installed token-ring standard LAN, regardless of what brand name it bears, is good for the company.

-Frank J. Derfler, Jr.

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■ IBM'S TOKEN-RING LAN

along the bus complicate the workload of each network interface device.

Some critics might say the token system causes a lot of idle time on the network and that it is an inefficient way to handle short, burstlike transmissions from a number of stations. CSMA uses the media for more time in many situations. An IBM engineer would probably agree that CSMA produces the shortest delay under light workload and then point again to IBM's corporate vision of the data future. The token-passing scheme is an efficient way to handle heavy traffic.

A ring is only as reliable as its weakest station. Every unit on the network is an active repeater, and if one unit dies, the network dies. However, the star-ring arrangement of the token-ring plan facilitates easy troubleshooting and bypassing of malfunctioning units. The Multistation Access Unit provides one place where all the network stations can be checked. IBM knows that there has to be an easy way to bypass a weak link in the chain.

All this means that technically the token-ring system should be more efficient and cost-effective for tomorrow's data environment. But if this kind of system has any limitation, it is possibly the speed of data transmission and the lack of ability to carry other services such as video. Some network vendors have made a big deal about the ability to carry voice, data, and video on the same cables. IBM has an alternative there, too.

IBM'S WIRING PLAN IBM's various families of systems use many different kinds of wire to connect together. The 3270 family uses 93-ohm coaxial cable to hook together terminals. A Broadband 75ohm coaxial cable connects the PC Network devices. The twin-axial cable of the IBM Series/1 and System 34-38 devices is a Siamese-twin version of the 3270 connection.

Two years ago, the company tried to bring all these types of connections together under the IBM Cabling System. This complete, expensive wiring scheme specified connecting cables to link all kinds of computing machines. Observers noted that for the first time IBM included twistedpair wiring in this system. So now the token-ring LAN, primarily a twisted-pair de-

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The sample screen display shown below is typical of what you see while editing a chert. Other screen dis-plays are provided for entering titles, changing options, getting "help" and so on

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■ IBM'S TOKEN-RING LAN

vice, has opened the bottom of the price envelope because it can use the least expensive kind of wiring.

IBM says that the network will run effectively at data rates of up to 16 megabits per second over shielded twisted-pair wiring. The speed you can get on unshielded wiring depends a lot on how much electrical interference the wire picks up in your installation, but the network is rated for 4

megabits per second in normal operation. It seems clear that the practical wiring scheme for most data installations in the future will be some combination of twisted-pair copper wires and optical fibers. The twisted-pair will carry voice and be the primary means of connecting to terminal devices. Optical fibers will carry heavy data loads and video, and they will be the alternative connection method for terminals in noisy RF environments.

WHAT NOW? PC Magazine has advised a "wait and see" attitude about LANs. The cost and effort involved in setting up a LAN is often underestimated and not justified by the application.

The introduction of the IBM token-ring LAN hasn't changed that advice very much. The cost of nulling wire and the workload of the network administrator will probably still shock you. But if you have found the right applications softwarefully compatible with networking software that runs on DOS 3.1-and if you either have had wiring pulled or understand the costs involved in doing so, then the time to set up a LAN may be now.

Useful standards have been established and are being followed. IBM has competition from heavily financed companies like AT&T and from innovative and aggressive firms like Fox Research. Novell and Microsoft are marketing standard LAN software, loosening any single corporate grip on the market. If you understand how high the jump is, the LAN industry is now firm enough to support your weight.

Frank J. Derfler, Jr., is a contributing editor of PC Magazine. William Stallings. Ph.D., is the author of Data and Computer Communications, published by Macmillan Publishing Co. Together they wrote A Manager's Guide to Local Networks, published by Prentice-Hall.

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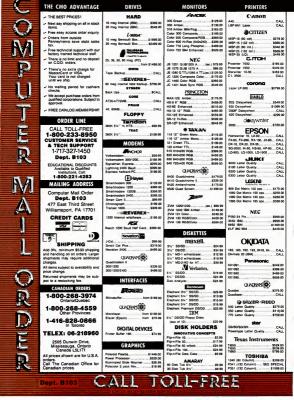
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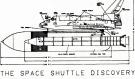
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Javelin

A NEW MODELER TAKES AIM AT 1-2-3

Javelin's well-designed approach to financial modeling offers some advantages over traditional spreadsheets. Will 1-2-3 users switch on masse? Fat chance

tom VisiCale to Super-Galle to 1-2-3, the spreadsheet has improved dramatically over the years. Now, there's a new program that sadok enough featurns and rows to give it a genuinely new approach to financial modeling. Joselin, the debut product of a new company, is aimed at the market now dominated by 1-2-3. Whether on or ican actually skewer the champ, Joselin looks like the first proceints fight.

Javelin has parted company with the standard spreadsheet in one fundamental way: Formulas and relationships aren't attached to individual cells. There's not a single E17- or A233-style cell address in

rom VisiCale to Superan entire Javelin model. Formulas deterclare 1, 1-2, 3, the
spreadsheet has imerate from "outside" the cell matrix on
proved dramatically
over the years. Now,
there's a new program
ordels much easily
order the years.

Another Javelin innovation is "views," or different perspectives on the same data. You can look at charts, raw data, formulas, and spreadsheets, all according to how the model makes the most

The program is easy to operate; it has sensibly laid out commands grouped into pop-up menus. Javelin imitiates 1-2-3, whenever possible, and so spreadsheet users will like the slash commands and the whole feel of the program. The basics are a snap to learn, but if you get bogged down, you can call up very thorough, context-sensitive help.



les : YTE(Total Sales)

Fremian for all variables: Expenses 1980 (2015) (Sept. Expenses 1980) (COME (Expenses 19 etal Sales : Fred Sales + Joe Sales

Figure 1: Top window: The table for the variable "Joe Sales." Bottom window: an alphabetical listing of the model's formulas.

Fred comission Jee comitation Book to a Toda t Talana (Bank annulus land lan annulus landa bekananan formulas for all variables that affect Profit: Frefit: Total Sales-(Fred commission/Am commission)-Expenses Total Sales: Fred Sales + Jee Sales Fred Eales: < Northly Acta: Exptember 1985 - Jensery 1986 >

Jon Sales: 4 Scothly Asta: Exptender 1965 - January 1966 b Fred Commission: 1 HTred Sales/1868, Fred Sales/4, Fred Sales/1868, Fred Sales/1868 es : PEDULCOM: Expenses 1-1.62.1500

Figure 2: Top window: A diagram of the "profit" variable. Bottom window: a list of formulas and variables that affect "profit."

BUILD A MODEL Let's say you are building a simple model for a business that has one product and two salesmen, Joe and Fred. You have to pay them commissions and meet other expenses, but everything else is profit. Javelin calls these numbers variables and recognizes two kinds; calculated variables and input variables.

A typical calculated variable would be Total Sales, which is the sum of Joe's sales and Fred's sales. Their sales are input variables: they are real-world numbers and not the results of a calculation. You can establish all three variables by entering a formula: Total Sales = Joe Sales + Fred Sales. It's easy to enter formulas; at the "ready" state (when you're not part-way into a command), you just start typing. And the formula uses English, not cell addresses.

To put real-world numbers into the model, you use a slash command to switch to Javelin's "table" view. Figure 1 shows the Javelin screen split into two windows. with the table for Joe Sales in the top window. It's set up in the default mode to accept monthly data, but you can run a model on days, weeks, months, quarters, years, or any two custom time periods you define. You enter Joe's sales figures as you get them; here you've gotten as far as January 1986. Fred's sales figures go into a similar table. Once you have this input data, Javelin will do the arithmetic to find Total Sales and put these figures in a table of their own

In the lower window of Figure 1 is a "formulas" view that lists all the model's formulas in alphabetical order. You don't actually enter formulas in rows like this. You enter them as they occur to you, but if you'd like to see them all, this is how Javelin displays them. If you want to see the values for the formulas, you switch to the tables view.

Several of the formulas in Figure 1 use some of over 70 Javelin functions that work just like built-in spreadsheet functions. Expenses, for example, are set to begin at \$1,500 and increase by 2 percent in each succeeding period. Fred's commission is set at 40 percent of sales if he sells more than \$10,000 worth, and at 35 percent if he sells less. Joe's works the same way. "ProfTrend" is a projection to January 1988 of profit figures based on profits so far, and "YTD Sales" are accumulated year-to-date figures.

One of Javelin's best features is the way it keeps track of how formulas and variables relate to each other. Anyone who has ever gotten lost in a labyrinth of spreadsheet cell relationships will be delighted with the two views in Figure 2. The top window is a "diagram" of the Profit variable. It shows which variables affect profit and which variables it affects. While you're in the diagram view, you can move around from one variable to another with the cursor keys to see how the model fits together. The diagram scrolls as you move from variable to variable.

The lower window of Figure 2 shows a different auditing view. It lists all the "roots" of Profit, that is, the variables and

formulas that affect it. There is also a "branches" view that, in turn, shows you everything that a variable affects. For complicated models, you would probably use the full screen for root or diagram listings rather than half screens as in Figure 2. Diagrams, roots, and branches are great help in keeping models accurate and under control.

THE BIG PICTURE The best way to get the big picture of a Javelin model is with the tried-and-true worksheet view, shown in Figure 3. To produce a worksheet, you enter the variable names in one border and the dates in the other, Javelin fills in the rest. In this case, only Joe's and Fred's sales figures are input variables; everything else is calculated.



In the worksheet view, you can enter data, copy formulas, define variables, sort rows, and do just about anything else. If you wanted to, you could build an entire model without leaving the worksheet view. You can set up any number of different worksheet views with different parts of the data from a single model. Since the relationships among variables continue even if some variables aren't in the worksheet. you can, if you like, show totals without showing the total's components. This technique is good for consolidation pages.

The most obvious feature of Javelin spreadsheets is that they don't have numbers and letters for rows and columns. You can't, therefore, identify an individual

Values can be dispersed over smaller time periods as well. If you enter a heading for October 17, 1985, you'll get a calculated value for one day's average sales. All Javelin time periods relate to each other. and so it's easy to move back and forth between them. This sort of thing would be a lot harder with a spreadsheet. Javelin is also smart enough to keep you from adding or subtracting values from unequal time

periods. Figure 4 shows two more views of Javelin data. The "notes" view (in the bottom window) is a space where you write little memos to yourself about what the variables in your model mean. In this case, the notes explain the chart view in the window ing blocks let you write lookup tables or consolidate data from many different Javelin models

All real contenders in the business market must have a macro language and Javelin has a good one. You can write macros by turning on "record" mode and entering keystrokes, or you can write the script directly. Macros can branch, prompt for user input, test for conditions, and nut up userdefined menus. The program has a singlestep mode for debugging macros.

NICE TOUCHES Clearly, a great deal of thought and care have gone into Javelin. It is loaded with nice touches that make it remarkably easy to use. Every time you



Figure 3: For an overall view of your model, Javelin can also be made to



These are the values of a straight line, fitted to the actual data according to the "lest apparen" tread formula.

Flaure 4: Top window: Javelin can quickly display charts of any variable. Bottom window: Adding comments to your variables.

cell, but most of the time you wouldn't want to anyway. Since each variable has an English name and each formula affects all the values for that variable, there's no need to identify cells. Moreover, by using English instead of cell addresses, Javelin makes formulas a lot easier to write and remember

look like a conventional worksheet.

Javelin's time periods are very useful in the worksheet view. Note, for example, that year-to-date sales accumulate to the end of 1985 and then start over. And any time you decide you'd like to consolidate monthly numbers into quarters or years, all you have to do is put the new time period in the top row along with the other dates. If you write a heading for third quarter 1985. all the monthly values for that quarter will consolidate into quarterly values and appear in that column.

above. It's a least-squares projection of profits to January 1988 based on the trend in the real profit data accumulated through January 1986; it will change as the real data changes.

You can get a quick chart view of any variable and display it on any monitor. If you have a graphics monitor, Javelin gives you good bar charts, line charts, pie charts, stacked bar charts, and x-y scatter plots. You can print any view, and you have the option of using headers, footers, and spe-

cial printer setup strings Javelin has several advanced features.

called "building blocks," that behave like complex built-in functions. One building block lets you specify time delays between variables so that a projection can anticipate delays in such things as receivables collection or subscription renewals. Other builduse a built-in function, for example, it prompts you for the next argument and tells you which ones are optional. Javelin always lets you know how much memory you have left and whether you have changed a model since you last read it into memory. It warns you if you are about to overwrite a file or leave the program without saving work. Whenever you have a choice, it proposes one based on what you did last; most of the time it's right.

Javelin tries to make using variables easy. A variable like Fred Commission is a lot easier to remember than a cell address like F75, but it's also a lot more characters. It would also be a pest to type if Javelin didn't do some of the typing for you. Whenever you need a name you've already defined, you need type only the first letter or two and hit the Tab key (which Javelin calls the Spell key). If there is only one name that begins with those letters, Javelin types the whole name for you. If there is more than one, Javelin puts up a quick menu for you to choose from.

This kind of attention extends to Javelin accessories. The manuals are easy to understand and well indexed, and the case study disks are helpful. There's nothing slipshod or hasty about this product.

COMPLAINTS But there are reasons to be compaliant form to costs point met. So compaliant form to costs too much. So post of so five are, especially when the established competition cost its end. So five are, especially when the established competition cost its set of RAM, you can might have to abandon a RAMISS, so for RAM, you can might have to abandon a RAMISS, use it, and with a six of copy protection which is a nuisance, although you can enter the control of the c

stating it (twice) entirety onto a hard oak. More seriously, the worksheet's screen refresh is slow. You can easily outrun it when you're entering data, and moving between pages is like pouring molasses. You can copy data in a worksheet, but you can't move it in a single operation. *Javelin* prevents you from adding weekly data to monthly data, say, but once you've lagged figures as dollars or pounds sterling, it lets you add them together.

These are quibbles, though, compared to Interfer Non real drawback as a spread-sheet loss of control over individual cells. For any calculated variable, you must give Javelin a formula that produces every value for that variable. That's fine for relationships that don't change (like Total Sales in Figure 1) or for ones that change smoothly (like Expenses in Figure 1). But not everything works that way. If, for example, you decided in Ferhary 1986 to change the commission structure for your change the commission structure for your (which you would type on one line) might look somethine like.

Joe Commission = END (Jan 86, IF (Joe Sales> 10000, Joe Sales*0.4, Joe Sales*0.35); BEGIN (Feb 86, IF (Joe Sales>15000, Joe Sales*0.45, Joe Sales*0.3)

The formula is a mess because it has to

THE COMPETITION

Although for most modeling Javelin may be easier to use, it lacks power in comparison with the dominant

standard, 1-2-3, whose new Version 2.0 is a real winner.

The market that Javelin is after is the toughest in the whole software industry. Spreadsheets not only launched the microcomputer revolution, but there are many fine ones out there already. Even worse, it's the one software niche that is overwhelmingly dominated by a single product Louts's 1-2-3.

1-2-3's success has built on itself. Once its market share reached critical mass, it became the industry standard and nothing else could touch it. New, if you build a 1-2-3 model, you can pass it along to colleagues or customers because they probably use 1-3-3 also. SuperCale 3 and Report Manager are first-standard successful and the successful succe

1-2-3 also does things Javelin doesn't try, like simple word processing and file management. With a few short macros, 1-2-3 becomes a surprisingly powerful word processor. Its database functions let you store and sort lists of data—a handy addition to a spreadsheet.

And 1-2-3 hasn't sat still, either. Version 2.0 comes with a raft of new features and is almost perfectly compatible with the old Release 1A. This compatibility lets you take advantage of Version 2.0's great new features without losing the models you built with 1A.

Version 2.0 lets you manipulate text strings almost as easily as numbers. This is a whole new bag of tricks, since you can now base decisions on text as well as numbers. For example, if you enter the name of a state in an invoice, a formula an now figure out what the sales tax rate will be. Or you can tell a database to update all the inventory part numbers that begin with the letters TR. Javelin can't deal with text this way.

Version 2.0's improved macro language also leaves Javelin way behind.

You can pass arguments to subroutines and set up sophisticated FOR-NEXT loops. You can test the contents of any cell in the worksheet and poll the keyboard for input while you are running a macro. And you can create ASCII files from within macros and read and write data. Not everyone uses advanced macro commands, but those who do want all the power they can get.

Version 2.0 can also handle international character sets and lets you embed printer control characters within a worksheet so that you can change print fonts at any point in your model. You can hide information in a spreadsheet or protect the whole thing with a password. Javelin has no security features.

1-23 and Javelin reflect different philosophies. 1-23 gives you as much power as possible. It tries to be easy to use too, but it gives you so many options that it takes real work to push it to its limits, lawelin also gives you power, but it does more of the work for you. It's easier to use, but it's not a flexible. It's the classic trade-off between a program that does a lot but makes you work for it, and one that does less but with less pain.

-Javed Tarvier



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BCD decimal math.

- BCD decimal math.

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* Source code companible between MS-DOS and

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Results of the Sieve benchmark BASICA QuickBASIC seconds per iteration 71 0.5

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*Subprograms can be called by name and passed
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Modular programming support

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JAVELIN

include the old commission rate as well as the new one. This sort of calculation is much easier with a spreadsheet because you can write a formula for any cell and change it or copy it any time.

It's also easy to make projections with a

are associated on formulas and then plunk in numbers wherever the projections don't look right. Javelin doesn't let you mix formula results and real numbers. In Figure 3, Expenses is based on a formula. If you try to change a number, Javelin will

This design means that it's cumbersome to make transitions from historical numbers to projections. Projections are based on formulas, whereas historical numbers are real. In a spreadsheet, you can mix them as much a you like, but with Javella you have to choose one or the other because a single formula governs a whole row of numbers. If you have to, you can write a formula that gives hard numbers for certain cells and then calculates the rest. For example:

Sales=19,700@Dec 85;23,700 @Jan 86;RANGE (Feb 86, Jan 88, PREVIOUS (Sales)*1.05)

This formula sets actual values for December 1985 and January 1986. Thereafter, sales increase 5 percent per period through January 1988. It's a simple concent but hard to express in Javelin.

How much do you suffer from losing the ability to control individual cells? Spreadsheet purists will think you suffer terribly, but it all depends on what kind of models you want to build. On balance, it's probably a small price to pay for convenient touches such as English variables and excellent model auditing good

Will Javelin end the reign of the spreadsheet? think not. It will probably win a devoted following, but too many people are already devoted to spreadsheets (see accompanying sidebar, "The Competition"). Javelin is a fine product, is nicely packaged, but has a few rough edges. In a fair fight with 1-2-3, it might win, but in a world that already runs on 1-2-3, it's in for a hard slog.

Jared Taylor, a contributing editor of PC Magazinc, edits the Spreadsheet Clinic column.

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CIRCLE 187 ON READER SERVICE CARD





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Getting the Most Out of Your HARDDISK

Although they take two different approaches, both
DiskOptimizer and Lightning pay big dividends in disk access
speed for a relatively small monetary investment.

s newer models of personal computers appear on the marker, many users may cast forlow looks toward their trusty, but somewhat dated, PCs and wonder if
there isn't something they can do to add a
little more life to the old beasts.

There are accelerator cards in abundance to increase performance by replacing the venerable 8088 of the PC with newer, faster CPUs. But processor time makes up only part of the delay between hitting Return and getting the desired results on-screen. Just as large a factor is the time spent waiting for the disk to carry out the tarny read and write requests sent to if

by the processor. As ever-faster hard disks appear on the market, you could always replace your older, slower units with the newest models. What you need is a less expensive solution—one that would elicit maximum performance from the unit you already own.

ameasy own.

Two products have recently appeared on the market to help scratch every wasted millisecond from your disk response times. DiskOptimizer from SoftLogic Solutions Inc. (the makers of DoubleDOS) and Lighming from the Personal Computer Support Group. Both of these products are reasonably priced at \$49.95—the unprotected version of Lighming, is \$95.5—and to the control of the products are reasonably priced at \$49.95—the unpro-

■ DISKOPTIMIZER AND LIGHTNING



BENCHMARK

To determine how much improvement one could expect from the disk optimization programs, I tested each program against unimproved DOS, both with and without a BUFFERS statement in the CONFIG.SYS file. First, I used Lightning's Analyze program to determine how fractured the "average" hard disk was. I found numbers ranging all the way from 85 percent to 4 percent, where 100 percent represents a fully and sequentially packed disk and 0 percent a totally fractured disk (meaning that no two clusters of any given file were found next to each other on the disk). This was disappointing, as I had hoped to discover a more consistent number. The disk that was 85 percent contiguous was not heavily used and was more than half full with program files. These were loaded immediately after the disk was initialized and never moved thereafter-a typical

situation for a single-purpose PC setup to true one program or package of programs. On the disk that was 4 percent configuous, files had been created and deleted numerous times, and the disk had not been reformatted for some 18 months. This was probably more typical of a hacker's disk. The men—if there was one—was around 75 percent, indicating that there-fourths of all the file clusters were contiguous with the next cluster of the same file.

To measure the effect of both optimizers, I generated three fractured files of different sizes. These files were artificially fractured by creating large dummy files, then appending these onto the original file. This broke the files into "chunks" spread across the surface of the disk. The larger files were broken into at least six pieces distributed over roughly 25 percent of the disk, which

represents a moderately fractured disk. The file sizes were 614K bytes, 205K bytes, and 43K bytes.

LIGHTNING For Lightning, the fractured files were measured under six different circumstances:

 1. unimproved DOS with no BUFF-ERS command in the CONFIG.SYS file (the most common case among all PCs)

unimproved DOS with BUFF-ERS=99 in the CONFIG.SYS file (giving DOS some caching room of its own)

Lightning with a 64K-byte cache
 Lightning with a 128K-byte cache

5. Lightning with a 192K-byte cache
6. Lightning with a 256K-byte cache
To reduce the effect of the disk opti-

mizing programs themselves on the overall result, I used the simplest DOS command possible to load each of the files. To facilitate more accurate measurement (and to get cache hits for *Lightning*), I performed this command ten times using the following. BAT file, which should be typed all on one lime:

Lightning vs. PC-DOS 3.0 PC-COO 120 DEFERRA-00 100 NEW 1100 NEW 11





PRUSE FOR \$51 IN (1 2 3 4 5 6 7 8 9 10) DO COPY BENCH\$1. DAT NUL:

Copying a file to the null device (NUL:) results in the file being read but not written by DOS. Using a FOR loop instead of ten COPY commands in the .BAT file keeps DOS from continually reaccessing the .BAT file, Thus, each time measured represents the shortest possible time for reading that file. Time was measured with a stopwatch from the PAUSE to the last COPY COMPLETE message. The results for a PC equipped with an external 20-megabyte XT-type hard disk formatted in 2K-byte clusters under PC-DOS 3.0 appear in the accompanying bar graphs. Measurements taken with the disk formatted under PC-DOS 2.1 were virtually identical.

Interpreting the test results is a trickier task than achieving them. The times for straight DOS improved by Lightning were worse in every case where the file size was greater than the cache size. This can be attributed to the overhead of maintaining the cache buffers.

in the control of the size decreased to less than the ciche size, the increase in performance was substantial. In this case, the first of the ten loops proceeded like a normal copy. After the first copy, however, the remarking nine copy, however, the remarking in the disk at all, since all of the file was already in cache via the first copy. Fully half of the measured time was consumed with the first copy. Here again the increase would be even more impressive on a PC capipped with a faster-than-standard proceptiped with a faster-than-standard pro-

DINOPITMIZER Running Disidymier to repeak the test files on a disinformated under PC DOS 3. Dock rought y 20 minutes and resulted in improvements varying from 21 percent for the larger files. Interestingly, the improvement under PC-DOS 2.1 was consistently in the low (20 percent) range. This most likely reflects the fact that on a 20 megabyte disk. 2.1 is cluster site in 8K-byte class opposed to 3.0 S. Ze byte class used to 10 megabyte disk. 2 is cluster site in 8K-byte site opposed to 3.0 S. Ze byte class upon the property of the prope

These results also indicate that a siginficant increase in disk performance can be achieved merely by adding a BUF-FERS—xx into your CONFIG.SVS file, where xx should be determined by trial and error. Users are making a mistake when they skip over the CONFIG.SVS section of their DOS manuals (PCSG recommends that you not install any BUFFERS when usine Lichtmine).

Beyond that, the improvement a potential user can expect from either Lightning or DiskOptimizer depends largely on the size of the files they will deal with. A writer or a programmer would rarely access files larger than the 43K-bvte test file and should therefore expect a considerable improvement in disa performed to the content of the products. A company database or accounts receivable file might be reach 614K. In this case, you would be reach 614K in this case, you would be reach 614K. In this case, you would consider the provement from DiskOptimitier. Of course, this might change in a situation where a database has grown over several months and has become considerably more fractured than the benchmark files!

CONCLUSION After having used both products over a period of time on hand disks formatted under both DOS 2.x. and 3.x. I feel it is fair to sdd a few subjective observations. For manipulating fairly small flies, Lightning is an excellent buy. Cache statistics reported by Lightning's status program rarely showed a hit ratio of less than 50 percent.

My personal experience tends to confirm these numbers. Once I had loaded up the cache buffers by entering a few commands in a directory, the disk speed rapidly approached near-RAMdisk speeds, with the hard disk hardly accessed at all. Since the cache method actually performs writes-to-disk. Lightninghas the advantage over RAMdisks of not losing data in a power failure.

The effect of DiskOptimizer did not seem nearly so large on my relatively unfractured disk. Bulletin board systems have a real problem with disk fracturing, so I collected observations from several BBS operators. They reported subjective access time improvements approaching 200 percent from usine DiskOptimizer.

Both Lightning and DiskOptimizer perform as advertised. For the potential performance increase, the purchase price seems quite reasonable. Both products have found a permanent place on my software shelf.—Stephen R. Davis both can result in significant performance improvements (see the accompanying benchmark test results) in existing disk storage systems. Although both can be used on floppy systems, I primarily deal with their effect on hard disk systems here.

LIGHTNING: HOW IT WORKS Lightning works by borrowing a trick from larger, mainframe-based operating systems: that of disk caching (pronounced "cashing"). If you were to examine how sectors are accessed off of a disk, you would find that over a short period of time a relatively

 Lightning works by borrowing a trick from larger, mainframe-based operating systems: that of disk caching.

small subset of the disk is accessed much more often than the rest. To see why this is so, imagine yourself as a programmer developing a C program. First, you might bring up your favorite editor, which you use to read and then write your C source program. You then use the C comoiler to read up the same C source program and create object code, which the linker reads up during the link step. When you find a bug in the program, the whole process is started over, typically using the same editor, compiler, linker, and source program. Therefore, those parts of the disk containing the C source file, editor, C compiler, and linker get accessed heavily, whereas other parts of the disk do not get accessed

at all.

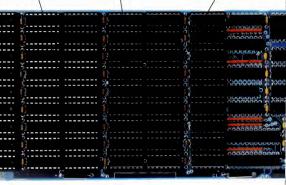
Like all cache programs, Lightning
must be installed into memory, much like
sideKick and ProKey, in order for it to
work. Once installed, Lightning maintains
a number of disk buffers that are known as
the cache. Whenever a user program requests DOS to perform a disk read, Lightning intercepts the request and checks its
cache buffers to see if it does not already
have that sector read into memory. If

Diaryofan

I traded my 16K machine and all those disks for Lotus* 1-2-3 and 256K. And immediately got the urge to merge. I started by merging regional statements in Maine. But before I could get to Iowa, I ran out of gas.

At 512K, I discovered what the coordinates IV169 looked like, I was so far out there it felt like I was walking on the moon. It didn't take long to find out 512K was nothing more than a walk around the block.

640K! Loads of space until I fell in love with integrated software and was back to cutting up files again. Sure, the other functions make my worksheet more persuasive, but I'm back to slugging in and out disks. Shades



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Above Board is the memory board that drove the Lotus "Intel/Microsoft" expanded memory specification, Infoworld's 1985 Peripheral Product of the Year.

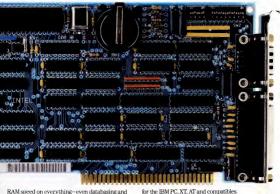
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■ DISKOPTIMIZER AND LIGHTNING

Lightning does not already have that sector in memory, it reads it from disk and saves it in one of the cache buffers before giving the user program a copy. If it has the sector in memory, it copies it from cache into the user's space, thereby avoiding the actual disk access. This is a cache "hit" and results in a much faster read, since RAM is faster than a mechanical disk drive (as anyone who has ever used a RAMdisk can testify). The cache hit ratio is the ratio of cache hits to all disk accesses.

Write requests must be honored whether the sector is present in cache or not; otherwise, data may be lost when the computer is turned off. However, if the sector being written is one of those held in cache. the cache buffer is updated in preparation for a future read. Lightning also performs one further check. If the sector to be written is exactly the same as the buffer in cache, then Lightning knows that no change has been made to the sector and skips the actual write.

Once all of the cache buffers have something in them, one of the buffers must be "flushed" of its contents to make room for subsequent requests. The algorithm that a caching program like Lightning uses to decide which one to dispose of determines how well the program will perform in actual use. Flush the wrong sectors and time will be wasted reading them back up from disk when they are later requested by the user program.

DISKOPTIMIZER: HOW IT WORKS DiskOptimizer from SoftLogic Solutions relies on a mechanical fact of life of disk drives: The time it takes to position the head over a sector on the disk is a function of how far the head must travel. Thus, a disk drive can step over to read a file only one track away much faster than it moves to a file on the opposite side of the disk.

Unfortunately, DOS does not seem to be aware of this phenomenon. When DOS allocates space on the disk for a file, it allocates the first available clusters it can find. even if the clusters it finds are not near each other (a cluster is the minimum grouping of sectors that DOS will allocate at one time).

For example, suppose you asked DOS to create a file two clusters in length and your disk was half full, except for one clus-

 DiskOptimizer repacks a disk, placing all of the clusters of each file next to each other to minimize disk read and write times.

ter at the very beginning. This cluster might have been freed by deleting a file or shrinking the size of an existing file. DOS would put the first cluster of our file in the single free cluster at the beginning of the disk and the second about midway out on the disk, where the remainder of the free space started. This file is now said to be fractured. Since the disk must move the head halfway across the disk to get from the first cluster to the second, this file will always he slower to read and write than a nonfractured file.

In applications where files tend to get copied to disk and stay there with little or no deletions or changes in size, disk fracturing is probably not much of a problem. But in applications where files are created, deleted, or often changed in size-such as disks used primarily for business accounting or database maintenance-the time lost because of disk fracturing may become considerable. This results in slowly increasing load and store times.

DiskOptimizer "repacks" a disk, placing all of the clusters of each file next to each other (such a packed file is said to be contiguous). This results in the minimum amount of head motion when these files are accessed, in turn resulting in minimum disk read and write times.

LIGHTNING BASICS The \$49.95 Lightning, Version 3.03, package from the Personal Computer Support Group comes in an attractive binder, roughly the same height as IBM and Compaq documentation. The manual begins with a clear explanation of the principles of operation so that even the novice users know what it is they are installing in their systems. Following this is a description of the allowed arguments to Lightning and a listing of error responses and what they might mean. No index is provided, but all of the legal arguments to Lightning are summarized in a one-page set of examples and in a help menu within the program itself. A help number is provided for customer assistance, but it is not toll free.

The \$89.95 version of Lightning is not copy protected, so installing it onto a hard disk is merely a matter of copying it into a directory available at bootup. Lightning is normally installed in the AUTOEXEC file to be loaded at bootup and then may be forgotten. Lightning uses up roughly 8K. bytes, plus however much space is allocated for disk caching. In general, the more space allocated, the more improvement you could expect. Lightning will work with all versions of PC-DOS (it does not work with



DOS 2.0 and late

(214) 351-0564 Requires: 256K RAM,

List Price: \$49.95 (protected); \$89.95 In Short: Improves DOS disk access times

by providing disk cache capability. Works well when cache size is larger than the average file being worked with



DiskOptimizer SoftLogic Solutions 530 Chestnut St Manchester, NH 03101 (800) 272-9900 List Price: \$49.95 plus \$5 shipping and handling Requires: 128K RAM.

PC-DOS 2.0 and later or MS/DOS 2.11 In Short: Repacks a disk so that all files are stored contiguously and with the other files from the same directory. This minim head movement, resulting in faster disk ac-CIRCLE 606 ON READER SERVICE CARL

MS-DOS, however), but the maximum cache size is 63K bytes with DOS 1.x. Lightning allows for cache sizes of up to 1.5 megabytes with IntelLotus "Above Board" compatible memory cards.

Immediately after Lightning is installed, you notice no improvement. This is because the disk buffers are empty and so no cache hits occur to speed up response time. After a few disk accesses, however, the buffers begin to fill up and cache hits begin to become ever more common. The percentage of cache hits is highly dependent upon how big Lightning's buffer space is and how big the files are that you are working with. If your work is more or less confined to a few directories (as in the case of the C programmer in the example) and if the total size of the files you are accessing is smaller than the cache size, Lightning rapidly begins to assume RAMdisk performance. If you are jumping rapidly from one directory to another or working with files that are very much larger than the cache-space size, then no improvement may be detected at all.

Lightning also includes some secondary disk utilities. One allows you to examine the cache hit ratio. This ratio is a good indication of how much improvement you are getting: Zero percent cache hits indicates no improvement, while 100 percent indicates you are running at RAMdisk speed. Other utilities allow you to software write-protect the disk and encrypt or deencrypt files.

DISKOPTIMIZER BASICS The 499 59 DiskOptimizer from SoftLogic Sotulutions comes in a similar-sized binder. The disk itself is contained in sealed comparing the state of the st

separate chapter to each program contained on the program disk. Both an index and a table of contents are provided. The DiskOptimizer program itself is copy protected; the other programs on the distribution disk are not. You are allowed to make two copies in addition to the master, which can also be executed. A noncopy-protected version may be had by signing a nondisclosure agreement and sending in another \$25.

A help number is provided to registered purchasers as well as a computer bulletin board system (BBS) for owners of any SoftLogic products. The BBS is designed for exchange of hints, help, additional support programs, and updates. Neither the help nor the BBS number is boll free.

As mentioned, the DiskOptimizer program repacks the files on a disk, so that each file occupies a contiguous series of clusters with no blank areas in the middle. Once the disk has placed its read/write heads to access the first sector of a repacked file, it can read up the entire thing with, at most, single-track steps every 17 sectors. DiskOptimizer also attempts to place all of the files from one directory adjacent to each other on-disk. Apparently, the hope here is that you are more likely to access files in the same directory than files from other directories. Thus, as long as you are in one directory, the disk head would tend to stay over one physical area of the recording surface.

area or me recotting surface.

Because nothing is left in memory during optimization. Softlogic guarantees that the optimization process is safe. If the disk were unphagged during the optimization proper and experiment of the properties of the control of the properties and on the condense of the control o

Softlogic includes several extra utilities, the most useful of which is a disk analyzer. This program attempts to show you have been a several disk is, so that you can not. Unfortunately, the algorithm used does not generate much useful information in making such an analysis. Peter Norton's Norton Utilities program for examining the actual layout of files on the disk is a much more useful tool for making such a packing a disk every 1 to 6 months, depending on use.

Stephen R. Davis is senior electronics systems engineer with a defense contractor in Greenville, Texas.



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OFTWARE

uccessful competition in the free market is usually a matter of having the best product at the best price with the best service. But every good salesperson also knows that there's more to selling than that. Although a polished presentation and command of the important facts and figures may not win you contracts, it can't hurt. Appearing unprofessional or disorganized can; it will certainly cause you to lose sales.

In the last few years software that gives the sales force a boost has begun to enter the market. Originally limited to writing letters and calculating costs, software to assist salespeople has now expanded into such areas as strategic planning and sales training.

This article reviews sales-oriented software from three firms. PowerBase Systems offers applications for the Power-Base database manager that handle both prospect tracking and expense recording. Thoughtware sells a series of systems called Sell!Sell!Sell! that cover sales training and evaluation, prospect evaluation, strategic planning, and managing basic facts about customers and prospects. And finally, Excalibur Sources offers ExSell, a prospect-tracking system whose design emphasizes telemarketing. As you'll see, these systems are significantly different from one another. Each has its own advantages and drawbacks.

POWER-BASE APPLICATIONS

Power-Base is a well-regarded PC database manager with "relational" abilities and a powerful report writer. PowerBase Systems, the company that markets Power-Base, also sells "applications," predefined sets of files and reports that "program" the Power-Base database manager. When you install a Power-Base application along with Power-Base itself, the result is a system ready to accept your data and produce reports. You must, of course. own both the application and the database management software.

Three applications are included with the Power-Base database manager; a phone directory, a stock-tracking system, and a project management system. Others are available at extra cost, including the Business Travel & Entertainment Management and the Sales Prospect Tracking applications.

The T&E Management application is intended to record and track the flow of expense money between a company and its employees. Overall, it does an excellent job. T&E Management reports expenses by department and employee, and it records and reports the movement of money and the amounts due in both directions. Unlike some competing software, it allows quite adequate space for comments on expense accounts.

T&E Management does not handle account numbers but does allow you to enter department numbers, which in some businesses is almost the same thing. It will interface with outside check writers and other financial systems, but it does so through normal Power-Base facilities and requires you to program the interface using Power-Base. In some cases, this ability will per-

for the SALES FORCE

software packages can do much more than write letters and calculate costs Power-Base. Sell!Sell!Sell!.

and ExSell can help with planning, training, and manaeine details.

These

sales-oriented

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■ SALES SOFTWARE

mit integration of T&E Management into an overall accounting system, doubling and redoubling the value of the software.

The Sales Prospect Tracking application is a good basic prospect-tracking system. It records prospect information, including names and addresses, contact names and phone numbers, regions, territories, sales people, sales quotas, call reports, special deals, contacts, leads, directions to get there, and a phone log. With it

you can create your own prospect types and classify prospects by type for reporting purposes. It produces call reports, quota achievement reports, a lead follow-up schedule, sales reports, and special deal reports. It also produces mailing labels and a phone log.

Sales Prospect Tracking does not make sales projections, track lead sources, summarize business by source, handle multiple salespeople assigned to a single account, calculate commissions, or assist in strategic planning.

Both applications have some quirks unique to Power-Base. For instance, you must establish links between files manually as records are entered because Power-Base doesn't support automatic linking. The "zooming" process, as Power-Base calls it, can be complicated and may be difficult for a new or inexperienced user to

In addition, I found the documentation of both of these applications to be skimpy at best. T&E Management has 10 pages of documentation; Sales Prospect Tracking has 15 On the other hand, the Power-Rose database manager documentation is hundreds of pages long and supplements the application documents for some purposes.

A significant plus is the power and flexibility of the Power-Base software itself. If you are willing to invest the time and effort to learn Power-Base, the applications can be a starting point for nearly anything you want to do-Power-Base enables you to change files, add new files, and define reports. On the other hand, if you're interested only in using the applications as they stand, you need relatively little knowledge of Power-Base.

Power-Base and its applications are not copy protected. If you already own the Power-Base database manager, you can hardly go wrong with the applications, as they cost only \$29.95 each. Even if you don't own Power-Base, the flexibility of both the T&E Management and the Sales Prospect Tracking applications makes them useful and worthwhile.

SELLISELLISELLI Sell! Sell! Sell! (which I'll abbreviate as \$3) consists of three major systems: Assessment, Sales Training, and Applications. The Applications system itself has five subsystems,

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Business Travel & Entertainment Management application, \$29.95; Sales Prospect Tracking application, Requires: 320K RAM, two disk drives. In Short: The T&E application is an excellent standalone expense account tracking sys-

tem. Sales Prospect Tracking is a basic system with flexibility, provided you're willing to learn Power-Base PACLE 698 IN READER SERVICE CARD

Sell!Sell!Sell! Thoughtware Coconut Grove, FL (800) THT-WARE List Price: Sales Train ing and Assessment sys-

tems, \$495; Applications system, \$295 Requires: 192K RAM, two disk drives In Short: Training and Assessment systems provide formal sales training. Applications system offers excellent strategy planning, but prospect tracking needs more features.

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SALES SOFTWARE

one of which fills five separate functions. \$3, as you might gather, is a lot of software. In fact, it comes on a total of 15 flop-

py disks.

\$3's documentation rates well by my standards. I found it easy to work with and well organized. A glossary of terms is included; unfortunately, a subject index is

The Assessment and Sales Training systems are "computer-based training," sold together as a package. The Assessment system is designed to measure an individual's potential in sales; the Sales Training system teaches sales technique.

and skills.

The Assessment system is divided into four parts: program instructions (which consist of more than keyboard familiarization), aptitude testing, skill testing, and

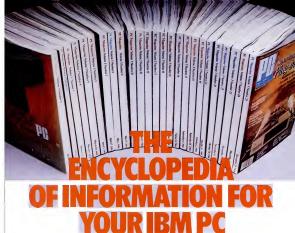
customer evaluation. The Assessment system is typical of many aptitude tests. It leads you through a number of sometimes subjective and often downright fluzzy questions and asks you to choose among several highly specific multiple-choice answers. After you've completed the test, the system cross-analyzes your responses and produces printed output containing specifsessment and with the system of the system of the sessment and are not useful for management assessment of subsecoption or as a preent assessment of subsecoption or as a pre-

I took both the aptitude and the skills tests. 53 asked me 108 questions and produced 23 pages of printed output. According to 53, I can be only moderately successful as a salesperson, and I need to work harder on planning sales calls. In my case,

employment test.

Sales Software: Summary of Features

			LAGE
Time and expense reporting	of the second	41.0	P C
Advances	Yes	No	No
Expense statementa	Yes	Yes	No
Payments	Yes	No	No
Department/account aummaries	Yes	No	No
Prospect tracking			
Basic name and address	Yes	Yes	Yes
Last and next contact dates	No	Yes	Yes
Region/territory designation	Yes	No	Yes*
Multiple sales reps/database	Yes	No	Yes*
Multiple contact names	Yes	No	Yes*
Quotas	Yes	No	No
Commissions	Yes	Yes	No
Lead follow-up tickier	Yes	Yes	Yes
Call reports (comments)	Yes	No	Yes
Sales tracking	Yes	No	No
Strategy planning	No	Yes	No
Call analysis	No	Yes	No
Quote tracking	No	No	Yes
Dialing ssaistance	No	Yes	Yes
Move prospect disk-to-disk	No	No	Yes
Salea training			
Skills/eptitudes assessment	No	Yes	No
Techniques training	No	Yes	No
Other functions		2 1000	A 187
Appointment calendar	No	Yes	No
Address book	No	Yes	No
Memo writer	No	Yes	No
Other features			
Copy protected	No	Yes	Yes
Toll-free support number	No	Yes	No
Documentation	Slim	Good	Goo
Help screene	No	Yes	Yes



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tions over a single line while actually viewing 8 of them simultaneously through "windows" on your screen. At the same time, it automatically checks for data errors during transmission. In addition, Access has bull-in interfaces for the information services you need, like CompuServe" and Dow Jones New/Retrieval. And the Access Learn command turns long command sequences into one-stroke functions that quickly get you on your way to solving problems and doing business.

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It's a system even Sam Morse would be proud of.





■ SALES SOFTWARE

this evaluation is probably accurate; I've often been glad I'm not paid on my ability to sell.

S3's computer-based training and aptitude testing concepts are not new and have been proven to be useful. But there can be problems. Revealing your inner thoughts and fears, even to a computer, can somehow be both emotional and threatening. Partly this is because you don't understand what's going on inside the computer and cannot predict how your answers will affect the overall evaluation. You're tempted to enter answers simply to improve the evaluation, even after being told that only honest input will produce useful output. You never know the degree to which the test results have been affected by conscious or subconscious attempts to manipulate the system.

Despite these concerns, most people plod through aptitude tests and when it's all over, agree that the results weren't entirely unreasonable. In fact, later, after the emotion has drained away, most will admit that they learned something from the tests and are glad they took them.

CUSTOMER EVALUATION The fourth and final part of the Assessment system is directed at customer evaluation. \$3

attempts to establish the tenor of the customer's organization and the people in it and to determine how best to sell in that specific instance

Customer evaluation is much less emotional and much easier to accept than personal evaluation. The software works the same way as the aptitude and skills evaluation sections, with many subjective questions followed by a report. Since the topic is now the customer, rather than the salesperson, the questions are more objective, and the results are easier to evaluate.

I subjected one of my customers to the S3 evaluation. According to S3, this organization is free spending, people oriented, and concerned about both the short-term and the long-term future. This analysis seems accurate but tells me little that I didn't know in the first place. The value of customer evaluation can sometimes be in confirming and solidifying the things that a salesperson senses but has not been able to put into words

The S3 Sales Training system is also



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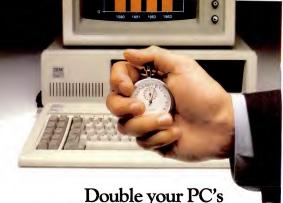




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SALES SOFTWARE

oriented toward the individual salesperson. It teaches techniques for precall planning, call conduct, and customer questioning. According to Thoughtware, the contents of the Sales Training system were drawn primarily from the McGraw-Hill sales training seminars and lean heavily on experience gained by McGraw-Hill.

A major value of this tool is a consistent, methodical, and effective way of approaching a selling situation. Using the techniques presented here may not guarantee a sale, but in some situations, igno-

rance of them can lose one. However, all training systems provide only the mental tools. You must supply the motivation and energy required to use them. Too often, enthusiasm generated during the training process fades quickly, and you're left with only a general understanding of some concents. Although general knowledge is almost never bad, the real value of this and all similar sales training programs comes in the actual application of the techniques. For optimal results, sales management should take the training course, preferably before the salespeople take it, and should insist that the staff use the techniques as part of the normal company selling process.

Thoughtware's \$3 Sales Training system presents material that covers all the basics without obvious error and without software bugs. But it has, in my opinion, two minor flaws. First, in certain places the student isn't adequately involved and only button-pushing is required. It can be too easy to go through the motions without any real learning taking place. Second. \$3's software allows beginning salespeople to simply follow the on-screen menus and instructions to get a complete course in selling techniques. The system, however, should also have a fast track for experienced people.

FIVE APPLICATIONS SUBSYS-TEMS The third major Thoughtware system is called Applications. This system includes five subsystems: prospect tracking, strategy planning, task management,

sales coaching, and customer size-up. The prospect-tracking subsystem stores a customer or prospect's name and address, a contact name and phone number. the last and next contact dates, up to three

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SALES SOFTWARE

products, up to three undefined search codes, and up to 236 characters of notes. In addition, prospect tracking can store form letters and merge them with the prospect database on either a scheduled or an unscheduled basis to produce standard letters and mailing labels. The word processor used to maintain the form letters is also adequate for occasional memos and nonstandard letters, but it can't compete with fullfunction word processors when 50-page proposals are in the works.

The prospect-tracking subsystem also includes an autodial feature that will access prospect data, automatically dial the stored number (including outside line codes, access codes, and so forth), and give you access to a tickler file update after a sales call is complete. Using the autodial feature, of course, requires a modem.

Only two reports are included: a prospect summary and a detail. You can enter record selection criteria, but you have no

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control over the sort sequence. The only available screen retrieval is a one-prospect-at-a time detail.

PLANNING STRATEGIES The S3 strategy-planning subsystem is quite robust. You define market segments, product features and benefits, possible customer objectives and objections to the product. and ways to handle objections. The software assists in establishing a customer profile and uses the accumulated data to guide you through the planning process for a specific call.

After you've completed the sales call, you enter the results with the strategy-planning subsystem, which also advises you on how to improve your performance on the next call. Most valuable, it collects success and failure information for different strategies and, after a period of time, will tell

you which are most effective. S3's strategy-planning reports are simple, with minimal options and minimal flexibility. The system can print charts, lists, and probability reports and can direct the reports either to the screen or to a printer. Unfortunately, strategy planning does not share files with the prospect-tracking subsystem. You must enter data about a prospect into each subsystem separately.

The task management subsystem includes an appointment book, expense-reporting functions, a commission calculator, a memo and note writer, and an interface to Thoughtware's Trigger software. Trigger is a separate software package and is not reviewed in this article. According to Thoughtware, Trigger gathers information about calls and call results from a number of S3 users and allows a sales manager to review and analyze the activities of a group of salespeople.

The task management appointment book allows appointments to be entered and will display either a 1-day calendar

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showing the details of your appointments for the day, or a 1-month calendar that shows no detail but indicates those days on which something is scheduled. The only printed report is for the 1-month calendar, although you can use the PrtSc key to print out details a day at a time. I found the ap-

pointment book of limited value. Expense-reporting software is better but still limited. You define categories (such as airfare, meals, and hotels) and enter total expenses by category by day. The system presents summaries by category, week, and month. No expense details are allowed; no comment space is provided. It ignores cash advances, repayments, and reimbursements.

The commission calculator is really minimal. You enter the unit sales value, the number of units sold, and the commission rate by product by week. The software calculates commissions. With the task manager's "personal secretary" you can create and print memors, print labels, and print an address book. The software calculates to book is limited to "key personnel," as do fried in the prospect-tracking system—you can't add you current rounder lateral to the sold the sol

S3's Applications system also includes a sales coach and a customer size-up subsystem. Customer size-up is, as far as I can tell, a copy of the customer evaluation section of the Assessment system. If you don't buy the Assessment and Sales Training systems, the size-up features included in the Applications package are useful.

SALES COACH. The sales coach is intended to be used after a sales call has been the property of the sales call has been hand through the various parts of the sales call and asks pertinent questions like: "Did you affectively establish a rapport with the ustomer?" and so on. Based on your responses, it makes suggestions for improvement in the next call. I found the sales coach to be more required and therefore less useful than the customer size-up full points and can serve as a reminder of full points and can serve as a reminder of the multitude of things that fall by the wav-

nnouncing a complete internal half-high 60 megabyte tape backup system for your IBM PC, XT, or AT that backs up your hard disk automatically for only \$995

xpress Systems' AutoBak'" software will back-up your hard disk by image or file-by-file. And it will let you tell it to back-up automatically by date, time, extension, subdirectories, or everything since you last backed up.



For an additional \$250 you can own either the Express Systems half-high or full-height subsystems. Each subsystem

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figure that you can perform an image backup of a 20 megalyte hard disk in about of minutes. But practically speaking, once you back up your hard disk completely for the first time, you never need to do more than invoke the archive command that convenient command that tells your new tape drive to backup everything since you last backed up. If you backup as often as you should, your Express Systems tape drive will finish the job virtually in seconds.

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Before you get intimidated about installing our tape drive internally, you should understand that IBM doesn't thank it's too hard. They're selling IBM PC AT's with instructions on how to add additional hard disks in the Installation and Setup manual that comes with the AT. Our instructions for installing your new Express Systems tape drive follow IBM's clear, simple instructions.

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a pretty good thing to be famous for. Problem is.

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to know about. For instance, you may have accumulated so much data on your disk, you've forgotten where vou put it all. How do you organize your database so your information is manageable and accessible? First, List Directories

gives you a list of all the directories and subdirectories on your disk. Then Disk Sort

will sort all your directories five different ways. File Size gauges the amount of space your files occupy, to help you with transfers between

disks and storage. Sometimes you need to

track down a specific bit of data. It's not deleted, just mislaid, Search your directories to find the file by name with File Find. Or if you only remember a few identifying words of the file. Text Search will search

words, including erased file space. You can protect your data from harm with several of our other utilities. Disk Test will scan your disk for damaged sectors, unsafe

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tial. Data is wiped clear by file or disk never to be retrieved. Not even with UnErase.

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you vital information about your system, a graphic map of your disk space, and let you scan your disk and snoop through programs.

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Every day The

something, UnErase is always there. The Norton Utilities version 3.0 is designed for the IBM PC, PC-AT, and DOS compatibles. Available at Computerland and most software dealers. Order direct for \$99.95 from Peter Norton, 2210 Wilshire Boulevard, Santa Monica,

CA 90403, 213-399-3948, Visa and Mastereard welcome. TIME-LIFE ACCESS NEWSLETTER says "Highly recommended

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your entire disk for those LICENSES A life saver for your data. AVAILABLE.

SALES SOFTWARE

side in the daily rush.

All parts of the Thoughtware S3 system share several characteristics. They are all copy protected, although the Sales Training and Applications systems will run from a hard disk if you put the original disk in drive A:. And they are designed to be very easy to use, even for a novice. In fact, the S3 software comes close to being the slickest-looking software I've ever seen. Colors are nice, the menus are really classy, and the individual screens are well designed and easy to read and understand. S3 uses prewritten files, which impose

some limitations. The strategy-planning subsystem handles only 35 customers per database, the prospect-tracking subsystem up to 200.

EXSELL ExSell is the prospect-tracking system I use day in and day out to keep track of sales leads and quotations. I didn't happen to be the person who selected it in the company I work for, but if I were to make the decision now. I think I would stick with ExSell because it fits my business needs well and works smoothly.

ExSell is strictly a prospect, lead, and customer-tracking system. I've found its manual complete and easy to use, particularly since both a table of contents and an index are included

ExSell provides for the usual basic name, address, and telephone number of a customer and includes six user-definable and user-nameable fields. The system also allows for separate contact, quote, order, and comment histories.

The program does an especially nice job with telemarketing. From the main menu, you can request the tickler file with one keystroke. ExSell will fill the screen with a list of due and past-due follow-ups and contacts. You can select a contact to be made by moving the cursor to it and pressing the Enter key. ExSell will then bring up a screen of basic prospect information and will make histories available with another keystroke or two if they are needed.

Next, you can place a phone call to the prospect by moving the cursor to the correct place and pressing the Enter key. If your PC is equipped with the right autodial modem (either Hayes or Bizcomp), ExSell will do the dialing automatically.

Following the call, a few more key-

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■ SALES SOFTWARE

strokes will bring up a menu of possible standard responses (such as "busy," "no answer," "customer will call back," "send literatur," and others that year of make up yourself). With another keystroke or two, you can ling a standard response. You can enter notes and motify or add to may of the system's history files for that prospect. It deserted, Edd's will print out the prospect. It deserted, Edd's will print out the prospect to be deserted by the prospect of the prospect to call.

According to an Excalibur representative, by the time you read this article a new version of ExSelf will include a word processor for letters, a mail-merge capability with the prospect/customer database, and automated posting of these letters to the call history. The price cited for ExSelf in the Fact File that accompanies this article is the price for the new version.

ExSell's primary advantage over \$3 is

speed (it requires fewer keystrokes), reporting flexibility, and much more space to record comments and events.

ExSell's management reports include lead follow-up and customer status reports. The system is also capable of sorting and searching on nearly any database field except history.

On the negative side, ExSell does not attempt to handle commissions, experience or strategic or tactical planning. It does not forecast sales, ExSell is designed for usen't look at a subset of the tickler file or not on the tickler streen who is responsible for which prospect. However, ExSell does not does not only a single salesperson only. You can't look at a subset of the tickler file or not on the tickler streen who is responsible for which prospect. However, ExSell does also you to move prospects from one disk to another, and a multiuser version is available.

ExSell will run from a hard disk but only with the original diskette in drive A:. It is copy protected. THE WINNER? None of these systems is best for all purposes of or any spouse of possible spouse of the features of Self/Self/Self when I my to unique decistant my customers better. The decistant my customers better. The decistant my customers better. The substant my customers better. The statistics on the succession of various sellings strategies would strategie with the proposed of the statistics of the statistics and the power of Power-Race to provide the or two features I need that don't come with FeFul!

Like selling itself, choosing the right package for your needs is never a completely objective process. Each of the three programs is different; each has something that will sell you. But when it comes to choosing a winner, no clear champion emerges.

Jan B. Young is the director of Catalyst USA Inc., a turn-key minicomputer systems house.

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THE DOCTOR IS OUT

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President and Founder Tecmar

On the morning of October 7, 1981, Tecmar founder Dr. Marty Alpert sent two employees to Chicago to buy the first two IBM PCs ever sold retail, at a Sears store.

That evening, they returned to Cleveland and ripped them apart. They didn't even turn them on first.

On November 17—a mere six weeks later—Marty Alpert and Tecmar stunned the Comdex show by appearing with 20 peripherals for the new machine.

The IBM PC peripherals industry was born.

A Healthy Start
An unusual path took
Marty Alpert and his
company to the top of
the PC industry.

Trained as an engineer, Alpert grew interested in biological systems. He became a physi-

cian—a pulmonary specialist—and together with his wife, Carolyn, founded Tecmar in 1974 primarily to market a computerbased system he created to diagnose lung problems.

Tecmar's system was based on the same processor that the IBM PC was to use. So, when Big Blue unveiled its personal com-





puter for business, Tecmar was already one step ahead of its competitors-before it even had any.

A Prescription for Success

Four years later, Tecmar remains that step ahead, largely due to Marty Alpert's consistent knack for anticipating market openings and being there first with products that fill them. With over 500 employees-more than 50 of them product engineers-

Tecmar now produces the industry's most diverse and wide-ranging line of add-ons for the PC.

Small wonder, then, that Marty Alpert has no time to regret giving up his medical practice. Or that thousands of PC users in all walks of business are grateful that he did.

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SPEEDING UP YOUR KEYBOARD



If you find that the PC's typematic keystroke function trots rather than runs, the QUICKEYS utility will turn your keyboard into a thoroughbred.

sperienced PC users have long had reason to complain about the slow pace of the "typematic" action of IBM's keyboard. While having keys that automatically repeat as long as they are held down was once a productivity luxury for electric typewriters, such a feature became a necessity for a screen-oriented computer. It's depressing even to try to imagine having to press the Cursor right key 80 times instead of simply holding it down in order to move from column 1 to column 80 on the screen. The trouble is that, ever conservative, IBM kept the needs of the keyboard novice as its model when implementing the typematic feature on its first personal computers.

The microchip in the keyboard of the Coa mX T is designed to wait shout ½ second before it begins to repeat a key, after which the repetition rate is about 9 times per second. For inexperienced typeits the properties of the second typeits of

With the advent of the AT, IBM created a keyboard whose productivity could be increased to match the user's. Both the delay before repetition and the repetition rate are programmable, and many users have tweaked their keyboards for warp speed. Liftortunately, the AT keyboard is not downward compatible with the rest of the PC family, so a solution for increased productivity for XT and PC users has to be sought in software.

USING QUICKEYS IL.

UICKEYS in a modest little memory-resident routine that allows you to double (and even redouble) the typernatic speed on PCs, XTs, and their compatibles, ladeed, if can even augment the AT's typernatic indeed, if can even augment the AT's typernatic innection to get still greater speed with that reachine. Once you've installed it (either by putting it in your AUTOEKE/BAT file or typing QUICKEYS at the DOS groupd), you'll mover go back to IBM's design standards

When QUICKEYS.COM loads, it inserts itself into both the timer tick and keystroke interrupt chains inside the computer so the program can monitor each time the computer's internal clock ticks or any key is pressed or released. From that point on,

■ The microchip in the keyboard of the PC and XT is designed to wait about ½ second before it begins to repeat at about 9 times per second. QUICKEYS remains in memory until the machine is turned off or is rebooted with an Alt-Ctrl-Del sequence.

WHAT QUICKENS DOES Each time a new key is entered, QUICKEYS records the key and starts a delay countdown. If zero is reached before the key is released, QUICKEYS adds a new copy of the keystoke to the computer's keyboard to give and begins a new shorter countdown. Once zero is reached again, another copy of the same key is stored in the buffer and the short cycle begins once more. This year, but the computer is the computer of the same key is stored in the buffer and the short cycle begins once more. This year, but of the country of the same key is stored in the buffer and the short cycle begins once more. This year, another year, another key is presend, or the key-board buffer area is filled.

In practice, QUICKEYS can repeat keys far faster than some user programs can respond to them. Such a program response delay could cause you to hold down a key far longer than necessary, thus sending many more key repetitions than the program ought to receive. For example, a spreadsheet program might typically scroll across the sheet at about two columns per second while the Cursor right key is held down. Thus, to move right four columns would require four strokes on the Cursor right key and about 2 seconds. In the same two seconds, however, if you simply hold down the Cursor key rather than striking it each time, QUICKEYS will send 1 stroke in the first 1/3 second and another 30 in the following 12/3 second, at 18 repetitions per second. Assuming you have an extended keyboard buffer installed (and you're

■ PROGRAMMING/UTILITIES

wasting a lot of time if you don't), QU(CKEYS will have sent 31 Curso and keystrokes in the time it takes to scroll the four columns you desired. Thus, if you hold down the key while waiting for the program to reach the fourth column, there will still be 28 extra Cursor right keystrokes in the buffer. The spreadshed will then continue scrolling to the right until all the continues recolling to the right until all the extra keystrokes are used up—unless you have some means of getting rid of them.

ZAPPING THE KEYBOARD BUFFER Enter the Alt-Shift keyboard 2ap command. To let you delete any extra keystockes you may indevented yeard during slow user program responses, a keyboard "app" command is incorporated within QUICKEYS and will be active as long as QUICKEYS is reisdom. To delete any extra keys in the buffer (to instantly stop crolling right, for instance), you simply for the program of the program of the program has been program from the program of the key plat; it employs the keyboard bear has the plat; it employs the keyboard bear of the and the user program must wait for a new key to be prosed.

The combination of QUICKEYS's: high-speed pyematic action and its Al-Shift zap command provides a very handy way to scroll about the screen. Once the program is resident, simply hold down a cursor key for as long as you think it bakes to get where you're going, then sit back to get where you're going, then sit back to get where you're going, then sit back All and left Shift keys at the same time and continue with your work. It's a far more productive use of your time to send 18 strokes in a second and then do something stee while the screen scrolls than it is to hold the key down for 9 seconds while you wait to move 18 footumes.

RESOURCES REQUIRED QUIC-KEYS utilizes 54 bytes of memory each time it is loaded, which is a very small price to pay for effectively doubling the repetition rate of the PC or XT typematic keys. At only 280 bytes, the physical QUICKEYS.COM program file is also quite small enough to easily fit on most "boot" disketter.

Unlike most memory-resident programs, QUICKEYS can be loaded more than once during the session. Each time it

■ To let you delete extra keystrokes, a "zap" command is incorporated within QUICKEYS.

is loaded, the effective repetition speed increases again. For example, without OUICKEYS it takes almost 8 seconds for the keyboard's typematic feature to enter 80 asterisks at the DOS prompt. After loading OUICKEYS once, this time is reduced to about 3.5 seconds. A second loading of QUICKEYS reduces the time to about 2.5 seconds, and a third loading shaves another second from that figure. By that time, however, you're likely to find that the repeat rate is becoming too rapid for even a good typist to handle. Over the long haul, a single loading of QUICKEYS should prove about right for most competent typists.

QUICKEYSANAS For those of you who wish to enhance you keyboard's producivity but have little interest in technical matters, the QUICKEYSANAS listing is given in Figure 1. You can also download by modern from FC Magazine's 1 literactic with the property of the produced o

For the more technically inclined reader, the QUICKEY. SAM listing is shown in Figure 2, and it, too, is available by moden from the FC/IRS. If you ric comfortable with IBM's or Microsoft's Macro Assembler and are familiar with the ROM BIOS, the listing is self-documenting, and you need proced no further with this article. For those less familiar, the following background may be of help.

HOW QUICKEYS WORKS Whenever a key is pressed or released on the keyboard, the keyboard generates an Interrupt



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acv	BL, DUP_	DELAY2	JUST CHARACTER NOW STORED IN OLD TAIL. (COMPARE WITE PRINC REPERT CHARACTER AND STORE AS HEW REFERS EST. ASSURE CUD AND SEN CHARA DIFFERENT, SO WILL START SIGN. (OTHERNISM, THIS INTERMET HAS PROME HTD TYPHANISM AND SO STAY AT BI RATE.
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MOSS	DUP_CHT	CE-1	TOAN TICK COUNTER BACE ON.
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1887			TICE COURT READY. RETURN TO DIER.
THIPS .			a respective
,	*******		R INTERAUPT PROCESSING
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JNE	SCV2_CN		PAUTOMATIC REPEAT FLAG IS NOT ON OR THE
	DUP_CNT		TIESS TICK COUNT IS NOT SEND YET.
			'
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JNE	MOVE_ON		(1) PRUT PO.DT. OV. AND AV. SO COM
JNE	MOVE_ON		(1) SAVE ES, DI, SE, AND AX, SO CAN DES
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JNE POSH POSH POSH POSH POV NOV	MOVE_ON DS DI SX AR SX,SIGS DG, BX		(2) ESTABLISS SIGS DATA SECHENT
JRI PUSH PUSH PUSH PUSH PUSH NOV NOV	MOVE_ON DS DI SX AR SX,SIOS DG, BX SX,DS:[_SEG BIOS_TAIL]	(2) ESTABLISS SIGS DATA SECHENT
PUSH PUSH PUSH PUSH PUSH PUSH PUSH POV HOV HOV	MOVE_ON DS DI SX AR SX,SIOS DS, BX SX,DS:[(2) ESTABLISS SIGS DATA SECHENT
JRI PUSH PUSH PUSH PUSH POV NOV NOV ADD	MOVE_CN DS DI SX AR SX,SIOS DS,SX SX,DS:[DI,SE BS,210S	BIOS_TAIL]	TO DO THE STORIES. (2) ESTABLIS SIGN DATA ESCRENT ADDRESSABLITA. (3) GET CHREST TAIL LOCATION INTO SI. (4) RAFE POINTER, SO CAN FILL, IT ROOM. (5) SOWN TAIL POINTER TO SEXT WORD IS
PUSH PUSH PUSH PUSH PUSH PUSH PUSH POV HOV HOV	MOVE_CN DS DI SX AR SX,SIOS DS,SX SX,DS:[DI,SE BS,210S	BIOS_TAIL]	TO DO THE STORIES. (2) ESTABLIS SIGN DATA ESCRENT ADDRESSABLITA. (3) GET CHREST TAIL LOCATION INTO SI. (4) RAFE POINTER, SO CAN FILL, IT ROOM. (5) SOWN TAIL POINTER TO SEXT WORD IS
JRE POSH POSH POSH POSH POSH POSH POSH POSH	MOVE_ON DS DI SX AR SX,SIOS DS, EX SX,DS:[DI,RE BB,2	BIOS_TAIL]	(2) ESTABLISS SIDE DATA RECHEST (2) ADDRESSABILITY. (3) ADDRESSABILITY. (4) EAVE FOLKTIS, SO CAN FILL IT ROOM. (5) SOUS TALL POLYMER TO SELT WOOD IS.
JNE POSH POSH POSH POSH POSH POSH POSH POSH	MOVE_ON DS DS SX SX,SIOS DS,BX SX,DS:[DI,BS BB,2 SX,SIOS PDLL_CS SX,SIOS	BIOS_TAIL] _BND BCX _START	(2) ETHALIES TOO DAYS STOCKED, (2) ETHALIES TOO DAYS SECRET ADDRESSAN LITT. (3) CHT COMERCY TALL LOCATION INTO EX. (4) EARS FOLKTHAN, SO CAN FILL, IF MODA, (5) EARS FOLKTHAN, SO CAN FILL, IF MODA EXPERIMENTS OF SERVING IN
JRE POSH FUSH FUSH PUSH PUSH PUSH ROV ROV ROV ADD CRP JMB ROV FULL_CHECK F	MOVE_CN DS DI SX AR SX,SIOS DS,BX SX,DS:[DI,BE BB,2 SX,SIOS BB,2 SX,SIOS SX,BIOS SX,BIOS SX,BIOS	BIOS_TAIL] _END BCK _START	(2) ETHALIES TOO DAYS STOCKED, (2) ETHALIES TOO DAYS SECRET ADDRESSAN LITT. (3) CHT COMERCY TALL LOCATION INTO EX. (4) EARS FOLKTHAN, SO CAN FILL, IF MODA, (5) EARS FOLKTHAN, SO CAN FILL, IF MODA EXPERIMENTS OF SERVING IN
JRE POSH PUSH PUSH PUSH PUSH PUSH PUSH POV HOV HOV HOV ADD CRP JMB HOV FULL_CHECK:	MOVE_CN DS DS SX AR SX,SIOS DS,BX SX,DS:[DI,BS BB,2 SX,SIOS PDEL_CB SX,SIOS SX,BIOS SX,BIOS	BIOS_TAIL] _EMD BCX _START STOS_SEAD]	1 TO SO THE STOCKER. (3 STOCKERS SIDE DATA MERCHET ADDRESSES LITT. (3) GET CLEARET TALL LOCATION INTO SE. (4) EAVE POINTER, SO CAN PILL, IT MONE. (5) EAVE TALL POINTERS DET WAS DE- (5) EAVE TALL POINTERS DET WAS (6) IT MET LOCATION IN PART MOD OF EMPTRY WAS ADMINIST DET WAS (7) IT DET TALL IS EASE AS SEAD, THERE 1 HE'ST DOWN FOR ADMINIST CAMP.
JRE POSH POSH POSH POSH POSH POSH POSH POSY POSY POSY POSY POSY POSY POSY POSY	MOVE_CN DS DS SX AR SX,SIOS DS,BX SX,DS:[DI,BS BB,2 SX,SIOS PDEL_CB SX,SIOS SX,BIOS SX,BIOS	BIOS_TAIL] _EMD BCX _START STOS_SEAD]	(2) ETHALIES TOO DAYS STOCKED, (2) ETHALIES TOO DAYS SECRET ADDRESSAN LITT. (3) CHT COMERCY TALL LOCATION INTO EX. (4) EARS FOLKTHAN, SO CAN FILL, IF MODA, (5) EARS FOLKTHAN, SO CAN FILL, IF MODA EXPERIMENTS OF SERVING IN
JRE POSH POSH POSH POSH POSH POSH POSH POSH	MOVE_CN DS DI SX AR SX,SIOS DS,BX SX,DS:[DI,BE BB,2 SX,SIOS BB,2 SX,SIOS SX,BIOS SX,BIOS SX,BIOS	BIOS_TAIL] _EMD BCX _START STOS_SEAD]	1 TO SO THE STOCKER. (3 STOCKERS SIDE DATA MERCHET ADDRESSES LITT. (3) GET CLEARET TALL LOCATION INTO SE. (4) EAVE POINTER, SO CAN PILL, IT MONE. (5) EAVE TALL POINTERS DET WAS DE- (5) EAVE TALL POINTERS DET WAS (6) IT MET LOCATION IN PART MOD OF EMPTRY WAS ADMINIST DET WAS (7) IT DET TALL IS EASE AS SEAD, THERE 1 HE'ST DOWN FOR ADMINIST CAMP.
JRE POSH POSH POSH POSH POSH POSH POSH POSH	MOVE_CN DS DS SX AR SX,SIOS DS,BX SX,DS:[DI,BS BB,2 SX,SIOS PDEL_CB SX,SIOS SX,BIOS SX,BIOS	BIOS_TAIL] _EMD BCX _START STOS_SEAD]	TO SO THE STORME. (1) ESTRUCTURE SIGN DATA SERVING THE STORMEST THIS CONTINUE STORMEST THE STORMEST SO CAN THEM. IT BOOK AS SERVING SO CAN THE STORMEST SO CAN THEM. IT BOOK SEPTEMBRISHED THE STORMEST SO CAN THE SERVING SO SERVING SOURCE SERVING SE
JRE POSR POSR POSR POSR POSR POSR POSR POSR	MOVI_ON DE DI SX SX,SIOS SX,SIOS SX,DS:[DI,BE BB,2 SX,SIOS SX,SIOS SX,BIOS SX	BIOS_TAIL] _EMD BCX _START SIOS_SEAD] OM CS, F	TO SO THE STORME. (1) ESTRUCTURE SIGN DATA SERVING THE STORMEST THIS CONTINUE STORMEST THE STORMEST SO CAN THEM. IT BOOK AS SERVING SO CAN THE STORMEST SO CAN THEM. IT BOOK SEPTEMBRISHED THE STORMEST SO CAN THE SERVING SO SERVING SOURCE SERVING SE
JRE POSH POSH POSH POSH POSH POSH POSH POSH	MOVE_ON DS DS AR SX,SIOS DS, EX SX,DS:[DI,RE BS,2 SX,SIOS PDL_CS SX,SIOS PDL_CS SX,DS:[RAWS_SO DP_BAYS_SO DP_B	BIOS_TAIL] _END BCE _ETART BIOS_SEAD] ON CE, E	TO SO THE STRUME. (1) REPORT AND AND REPORT (1) OFF CREATER AND REPORT (3) OFF CREATER AND REPORT (4) SOOT SALE NOTHER TO SALE WORD IN (5) SOOT SALE NOTHER TO SALE WORD IN (6) IT WEST LOCATION IN BASE DOD IN (7) INT' BOOM FOR ADDRESS CLAR. (8) INT' BOOM FOR ADDRESS CLAR. (10) INT' BOOM FOR ADDRESS CLAR. (11) INT' BOOM FOR ADDRESS CLAR. (12) IN BOOM LEFT, BOUT THE REPORT BET
JRE PO SR PO SR PO SR PO SR PO SR PO SR NOV	MOVE_ON DS DS AR SX,SIOS DS, EX SX,DS:[DI,RE BS,2 SX,SIOS PDL_CS SX,SIOS PDL_CS SX,DS:[RAWS_SO DP_BAYS_SO DP_B	BIOS_TAIL] _EMD BCX _START SIOS_SEAD] OM CS, F	TO SO THE STORME. (1) ESTRUCTURE SIGN DATA SERVING THE STORMEST THIS CONTINUE STORMEST THE STORMEST SO CAN THEM. IT BOOK AS SERVING SO CAN THE STORMEST SO CAN THEM. IT BOOK SEPTEMBRISHED THE STORMEST SO CAN THE SERVING SO SERVING SOURCE SERVING SE
JRE POSH POSH POSH POSH POSH POSH POSH POSH	MOVI_ON DE DE DE DE DE DE DE DE DE DE	BIOS_TAIL] _EMD _ECC _START BIOS_EEAD] OH CB,E CBAR _TAIL],BX	TO DO THE STORMEN (1) STORMENT STORMENT OF STORMENT (1) OF COMMENT THE STORMENT OF STORMENT (2) OF COMMENT THE STORMENT OF STORMENT (3) OF STORMENT OF STORMENT OF STORMENT (4) OF STORMENT OF STORMENT OF STORMENT (5) OF STORMENT OF STORMENT OF STORMENT (6) OF STORMENT OF STORMENT OF STORMENT (7) OF STORMENT OF STORMENT (8) OF STORMENT OF STORMENT (9) OF S
JRE POSH FOSH FOSH FOSH FOSH FOSH FOSH FOSH F	MOVI_ON DE DI SX.SIOS DE, EX SX.SIOS DE, EX SX.SIOS SX.SIOS SX.SIOS SX.SIOS DE, EX SX.SIOS SX.SIOS SX.SIOS DE, EX SX.SIOS SX.S	BIOS_TAIL] _END ECK _START BIOS_SEAD] OM CB, E TOSE CBAR S_TAIL], BX DELAY2	TO DO THE STORM. (1) STREAM TO GENERAL STORMS TO BE A STORMS TO B
JRE POSH FUSH FUSH FUSH FUSH FUSH FUSH FUSH FU	MOVI_ON DE DE DE DE DE DE DE DE DE DE	BIOS_TAIL] _END ECK _START BIOS_SEAD] OM CB, E TOSE CBAR S_TAIL], BX DELAY2	TO SO THE STOKEN, (1) RETAILED STOKEN STOKENS (3) SET CREATER THE LOCATION STOKEN STOKEN (3) SET CREATER THE LOCATION STOKEN STOKEN (5) SOME STOKEN STOKEN STOKEN STOKEN STOKEN (6) SOME STOKEN STOKEN STOKEN STOKEN STOKEN (7) FAR STOKEN STOKEN AS SEED, THESE STOKEN STOKEN STOKEN AS SEED, (8) STOKEN STOKE
JRE POSH POSH POSH POSH POSH POSH POSH POSH	MOVI_ON DE DE DE DE DE DE SX AR SX,SIOS DE,EX SX,DE:[DE,EX SX,SIOS SX,SIOS SX,SIOS POLL_CE SX,SIOS POLL_CE SX,SIOS DEP_DET REQ_RES AX,OUP_DET REQ_RES AX,OUP_DET DET DET DET DET DET DET DET DET DET	BIOS_TAIL] _END ECK _START BIOS_SEAD] OM CB, E TOSE CBAR S_TAIL], BX DELAY2	13 STREAM TO SO THE STREAM THE STR
JRE POSH POSH POSH POSH POSH POSH POSH POSH	MOVIT_ON DE DE SX AR SX,SIOS DE, EX SX,DE:[D:,EX SX,SIOS POLL,CE SX,SIOS POLL,CE SX,SIOS POLL,CE SX,SIOS POLL,CE SX,SIOS POLL,CE SX,SIOS DOP_SX,SIOS DOP_SX,SIOS DOP_SX,SIOS DOP_SX,SIOS DOP_SX,SIOS DE:[EXD DOP_CXT	BIOS_TAIL] _END ECK _START BIOS_SEAD] OM CB, E TOSE CBAR S_TAIL], BX DELAY2	TO DO THE STOCKS. (1) STREAM TO GENERAL SECURITY TO SELECT CONTROL TO SELECT CONTROL THE STOCK CONTROL TO SELECT CONTROL THE S
JRE POSH POSH POSH POSH POSH POSH POSH POSH	MOVI_ON DE DE DE DE DE DE SX AR SX,SIOS DE,EX SX,DE:[DE,EX SX,SIOS SX,SIOS SX,SIOS POLL_CE SX,SIOS POLL_CE SX,SIOS DEP_DET REQ_RES AX,OUP_DET REQ_RES AX,OUP_DET DET DET DET DET DET DET DET DET DET	BIOS_TAIL] _END ECK _START BIOS_SEAD] OM CB, E TOSE CBAR S_TAIL], BX DELAY2	13 STREAM TO SO THE STREAM THE STR

9, which signals the computer that a keyboard event has occurred. The computer's read-only memory (ROM) contains basic input/output system (BIOS) instructions that control how the computer interprets these keyboard interruptions and what responses should be made.

If a shift key (Caps, NumLock, and so on) is being pressed or released, the ROM BIOS resets keyboard "flag" bits accordingly. One of these bits is turned on when the Alk key is pressed and remains on until the key is released. A similar bit is turned on and off when the left Shift key is pressed and released. These bit flags are stored at 17 in, "he-hexadocimal here) in the ROM BIOS data segment of memory (which begins at 40b).

(which origins at 40.0).

Pressing most nonshift keys causes the ROM BIOS to produce a 2- byte extended code that generally consists of "cancer to the code that generally consists of "cancer to the code of the

As new 2-byte character entries are added to the buffer, the tail keeps moving right until it reaches the end of the buffer (at 1Eh). The tail is then "wrapped" around to the left end (at 1Ch) and the character storage proceeds from left to right again.

As characters are "read" from the buffer by user programs, the head of the buffer, which points to the next character available to be read, is moved to the right. When the right side of the buffer is reached, it too wraps around to the left side to begin again.

Should the head ever catch up with the ail, the buffer is empty, that is, a character cannot be read from the buffer location until a new incoming character gets storacter. QUICKEYS uses this fact to zap the buffer. All the zap part of the command locs is set the head pointer equal to the tail pointer so that any program trying to read the buffer will think it is empty.

As QUICKEYS adds repetition charac-

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CIRCLE S18 ON READER SERVICE CARD

PROGRAMMING/UTILITIES

BOVE.	ON:		
	JRF	DWORD PTR ROW_INTE	JGO DO STANDARD TIMER INTERRUPT WORK.
INITI	ALIEE:	2 INI	TIALIE INTERRUPT VECTORS & AND 9.
,			
	ASSURE	DS:CSEG	
	XCK.	AX.AX	
	HOV	ES, AX AX, ES: [8*4]	ISET ES TO ABSOLUTE 0 (START OF VECTORS
	ROV	AX, ES: [8*4]	AX-OFFSET ADDRESS TO CURRENT TIRER CO.
	MOV		I RE-SEGRENT ADDRESS OF CURRENT TIMER OF
	MOV	CX. ES: [9*4]	: CX-OFFSET ADDRESS TO NOR XEYSTRONE CO
	HOV	DX, ES: [9*4+2]	I DX-SEGMENT ADDRESS OF BOM KEYSTROKE CO
	ROV	ROM_INTS,AX	
	ROV	ROM_INTE[2],BX	; SAVE CURRENT ADDRESSES FOR LATER DSE.
	ROV	RON_INTS,CX	
	MOA	ROM_1879[2].DX	
	CLI		
	LEA		JAX-OFFSET TO OUR TIMER CODE.
	MOV	ES: [E*4] .AX	PRESET TIMES VECTOR TO POINT TO OUR
	ROV	ES: [8*4+2] , CS	POFFSET AND CODE SEGMENT.
	LEA	AX, INTO	JAX-OFFSET -TO OUR XEYSTROKE CODE.
	HOV	ES: [9*4] - AX	PRESET KEYSTROKE VECTOR TO POINT TO
	NOV	25: [9*4+2] ,CS	JOUR OFFSET AND CODE SECMENT.
	STI		
	LEA	DX, INITIALIZE	POINT TO END OF CODE WE NEED TO REEP
	INT	27e	AND TERRIBATE SETUP OPERATION.

ters to the buffer, it first checks to see that enough room is available for one more character. If there is, it stores a new copy of the repeat character and moves the tail pointer to the next location. When no more room exists, QUICKEYS simply turns off its typematic repetition function and waits for the next lecystroke.

INITIALIZATION When QUICKEYS is first loaded, it changes as et of "interrupt vectors," which are simply pointers to be used when various interrupts occur, such as the press of a keystoke or the tick of the IBM PC's internal clock. By changing the timer and keystroke vectors, if forces its own instructions to be executed first, whenever either of these interrupts occur.

When a keystroke interrupt occurs, OUICKEYS turns off its internal typematic repetition function and then asks the ROM BIOS code to interpret the keystroke. The ROM BIOS then returns control to OUICKEYS, which checks to see if the Alt-Shift flags have been turned on or if a new key has been stored in the circular keystroke buffer. If Alt-left Shift has been pressed, the head pointer is set equal to the tail pointer, effectively eliminating any remaining characters from the buffer. However, if a new key has been entered, it is copied from the buffer and the delay counter is set before control is returned to the routine that was originally interrupted when the keystroke occurred. With each timer tick interrupt, control is turned over to QUIKEN'S, which first checks to see if its ypermatic function is on if frot, control is surply passed along to on. If rot, control is surply passed along to a timer tick occurs. If QUIKEN'S type-matic function is on, however, it next readies in deally count by one fick. If the result is not yet zero, control again passes but the passed in the passed in the passed in the careful passed passed to store a copy of the last key presend into the circular keystrike buffer. If successful, if then resets the delay presend into the corrol of the passed passed in the control of the passed in the country and most passed in the country of the passed in the passed

(Figure 2 ends)

COMPATIBILITY By relying on the ROM BIOS to interpret legytheric ROM BIOS to ROM BIOS T

Whether you run an IBM PC, XT, AT, or compatible, I recommend you take the time to install QUICKEYS each time you boot up. It will pay productivity dividends even for the hunt-and-peck artist.

Leo Forrest is president of Security Development Corp., which is currently developing pop-up utility software.

SPREADSHEET **CLINIC**



This forum lets readers exchange the ingenious solutions and timesaving hints that make their spreadsheets and integrated software packages work better.

BOMBPROOF USER INPUT

Interactive 1-2-3 templates are built so that they branch according to information entered by the user. The easiest way to set up this interaction is to use the /xn statement in a macro to ask the user for a number. which the macro then uses to choose the right branch. The trouble with /xn statements, however, is that they accept only numbers; an alphabetic character stops the macro and produces an error message. This spells trouble for new users, who don't know how to restart the macro.

Figure I shows an input template, which I call BombPruf, that eliminates the problem. It accepts only the numbers 1 through 6 and repeats the prompt for input if it gets anything different. This keeps even fumble-fingered me from bombing out. You can put this routine into any template that depends on numeric entry from the user.

BombPruf uses the /xl statement rather than /xn, because it's more forgiving and

accepts any kind of input. It then writes the input to cell D16 (SEL_INP) as a label. There it becomes part of the criterion range, INPUT, of the @dcount function in the second line of the macro. In cells E16 to E21 the function tests the input value against the valid options. Since the valid options are also listed as labels, they can be tested directly. If the input is valid, the macro iumps to \B. which turns the input value back into a number. The number can then be used as part of a macro branching

Just be sure to give the range names in column C to the cells to their right and to establish the @dcount ranges according to the table in Figure 1.

W S McCracken San Francisco, California

In Spreadsheet Clinic (PC Magazine, Volume 4 Number 24), there is a tip on how to build menus from which there is no esuntil he makes a valid choice. Mr. McCracken's method is a more economical way of doing the same thing.

PRINTING IN MULTIPLAN

In Spreadsheet Clinic (PC Magazine, Volume 4 Number 19) you gave some pointers on using printer setup strings in Multiplan. However, you don't have to use initial setup strings (as you suggest) to print in different fonts at different points within the spreadsheet. You can embed printer control codes in any cell to turn fonts on and

You do this by entering the printer control sequences directly into a cell, using the Alt-number pad technique. Control sequences differ from printer to printer, but the following examples will work with IBM Graphics and Epson printers.

If there is a part of the spreadsheet you would like to print in compressed type, go to a cell above or just to the left of that section. Enter the alpha mode and, while holding down the Alt key, type 15 on the number pad. Release the Alt key. A character that looks like a snowflake will appear. This is a graphic representation of ASCII character 15, which turns on compressed type. When Multiplan prints your spreadsheet, it will switch into compressed type when it gets to that cell. If you want emphasized type, you hold down the Alt key while you type 27, release the Alt key, and type 69.

If that's all you do, the entire spreadsheet will print out in the font you selected by entering the control sequence. To turn off a special font you must enter a different



Figure 1: A macro that allows "bomb proof" user entries.

■ SPREADSHEET CLINIC

sequence at the point where you want the special font to end. To turn off emphasized type, for example, you would type Alt-27 and then 70 instead of 69.

By mixing fonts within a single spreadsheet, you can use the full capabilities of your printer and vastly improve the appearance of your Multiplan printouts.

J. Craig Hearon Florence, South Carolina

IMPROVED 1-2-3 WORD PROCESSOR

I have been using the 1-2-3 mini word processor that appeared in Spreadsheet Clinic (PC Magazine, Volume 4 Number 21), It has most of the features I need for word processing, since I write only memos, letters, and short reports. However, the only way to go back and correct the text you are typing is to use the Backspace key, which

 This macro turns 1-2-3 into a surprisingly powerful little word processor.

erases everything before it. Using the cursor movement or Tab keys prematurely enters text and moves the cursor to a place where you don't want it.

There is a very simple fix to this problem: Just put {edit} at the beginning of the macro, as in Figure 2. The macro will work exactly as before, but you can now use the cursor movement and Tab keys, as well as End and Home to edit your text.

I have also added two {down} commands to each line of the macro so that after you enter the text, the cursor will skip a line before you start the next paragraph. J. David Highland

Austin, Texas

The initial (edit) is a great improvement; I wish I'd thought of it. I'm less keen on the additional (down)s, however, Since 1-2-3 will not let you write a label that is more than 240 characters long, it will beep when you reach the limit, and you have to hit Enter to keep going. With this version (edit){7}"/rj"/rncTEMP"{ba}.{down}"/xi@count(TEMP)>=2"{end}{down}{down}{down}/xg\W" {down}{down}/xg\W"

Figure 2: This macro will produce an improved 1-2-3 word processor.

below the intended end of the text, so you have to move back up one line and then hit F2 (Edit) to continue. If your paragraphs are usually shorter than 240 characters, the {down}s are a help, but otherwise

Some instructions for readers who didn't see the earlier column: Set the width of column A to however many characters you want your left margin to be. Set the width of column B to the number of characters you want in a line of text. Put the cursor in column B, run the macro, and type text until you get to the end of a paragraph or until 1-2-3 beeps. Then you simply press Enter.

You can use the " and " label prefixes to right-justify and center text, which is useful for address blocks, titles, dates, and so forth. Also, you can get out of the macro any time with Ctrl-Break and use /Move or Copy to edit text. This macro turns 1-2-3 into a powerful little word processor.

CONSOLIDATION CHECKSUMS

It is often useful to add the contents of several spreadsheets to each other to produce a consolidation. I have devised a simple, but foolproof way to make sure that I have added up all the spreadsheets correctly.

Suppose, for example, that you want to consolidate monthly spreadsheets into a single year-end master spreadsheet. Before combining the spreadsheets, put the control numbers from the chart in Figure 3 into the same cell location in each of the monthly spreadsheets. After you have



Figure 3: Control numbers to produce a checksum when consolidating year-end spreadsheets.

of the macro, the cursor ends up two lines combined all the spreadsheets, that cell location in the year-end master spreadsheet should contain the check sum 111.111.111.111. If you had forgotten to add the March spreadsheet, the number in consolidation would be 111, II1, III, 011 and you would know exactly what you had left out.

Had you accidentally added March twice, on the other hand, you would get 111,111,111,211. Now, all you have to do is subtract the March figures, and you will get the proper result: [11, [11, [11, [1]]. Also, if you find that there were errors in one of the monthly spreadsheets, you can subtract it from the consolidation for correction, and the checksum will keep track of what you have changed.

David R. Goodson Naperville, Illinois

This trick will work for any spreadsheet that lets you add different models to each

ASCII CHARACTERS IN WORK-SHEETS

other

Spreadsheet Clinic (PC Magazine, Volume 5 Number 4) contained an item from Jonathan Weidner that explained how to use a BASIC program to import low-numbered ASCII characters into a 1-2-3 worksheet. These can be used instead of keywords in macros and also to include commands like Tab and Shift-Tab that are not documented in 1-2-3.

In your comments, you say that it's amusing but not very useful to know that a smiling face can take the place of the word {up} in a 1-2-3 macro, but there are some extreme cases in which these characters can help. For example, the keyword {right} takes up seven characters, whereas ASCII 4, a diamond shape that does the same job, takes up only one character. You can string these characters together and cram a lot more cursor movement into the same spreadsheet.

However, when you use Mr. Weidner's method to import ASCII characters into a worksheet, you end up with only one ex-

■ SPREADSHEET CLINIC

ample of each character in the worksheet. You can /Copy characters to wherever you need them, but what if you wanted more than one ASCII 4 in a single cell? Since you can /Copy only the contents of entire cells, it looks like you're stuck.

The solution is to /Copy as many ASCII characters as you need into a single column. Then use /Range Justify to put the characters into the same cell. The only limit is that the cell can hold no more characters than it is wide. Also, since the /Range Justify command is meant to rearrange text, it leaves a space between each of your ASCII characters when it combines them in a single cell. You can go back to the cell and edit out the spaces if you like.

There's another way to compress your macros even further. Write a BASIC program that writes a string of up to 240 cursor movement characters and import that into a worksheet cell. You now have 240 movement commands in a single cell-

Many word processors

let you write unusual ASCII characters by using the Alt-number pad

sequence.

impossible with macro keywords, because of 1-2-3's 240-character limit. Finally, many word processors let you

write unusual ASCII characters by using the Alt-number pad sequence. This is an easy way to write files of ASCII sequences that you can then read into a worksheet. Michael Frank The next time I need 240 cursor movement commands in a single-cell macro, you can bet that Mr. Frank's method is the one I'll turn to.

There's also a useful tip here for 1-2-3 users who still use keywords in macros. The trick of copying characters to a column and then using the Range Justify command to bring them into the same cell also works with keywords. Of course, vou'll run into the column-width limitation a whole lot sooner with words than you will with characters.

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POWER USER

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DRAWING TREES IN TURBO

My Turbo Pascal program, DRAWTREE .PAS, draws a treelike structure that displays your hard disk's subdirectory organization. DRAWTREE can accept a drive or directory parameter. If you use a directory parameter, it will begin listing at that directory. It sure beats the normal DOS TREE utility, which I find utterly useless.

The program makes three types of DOS function calls, using Turbo's "intr" procedure: set dta, find first file, and find next file. The only tricky part of the program is the recursive function "listdir," which lists the directories but also calls itself to find nested subdirectories

One thing to note: The program is written to search for *.* entries, but if you don't use extensions on your directory names (and most people don't), you can change it to *, instead. This will speed up

the listing by almost 50 percent. Hector L. Santos Irwin, Pennsylvania

I hope Mr. Santos won't mind, but I trimmed his program down to about onesixth of its original size (Figure 1). I've set up an array of structures for the disk transfer areas (dta) used in searching for subdirectories. Each structure in the array is used for a different level of subdirectory nesting. The search string (called "search") exists only on the stack used by each recursive call of "listdir" -that way it can just be discarded when the search in one particular level is done.

Readers interested in the technique of searching through nested subdirectories

might also consult the description of my VTREE program ("A Sight Better Than TREE' PC Magazine, Volume 4 Number 22), which is an assembly language program that also draws a subdirectory tree.

It's interesting (and in retrospect, obvious) that a search for *. is much faster than the search for *.*, as Mr. Santos notes. Since DOS returns both files and directories when searching for directories, specifvine no extension ereatly reduces the number of times DOS returns control to the program and, consequently, the number of times the program has to call DOS

Turbo, Version 2, users should note

that, as presented in Figure 1, the program uses two Version 3 features that are unavailable to you. To use it, you should first take out the top line (the codes in the curly brackets). I've gotten into the habit of putting those compiler directives in Turbo code so the output looks more like that of normal programs. (Version 3 users can also redirect output to a file with these directives.) Second, you must replace the "paramstr (1)" near the end of the listing with an empty string (two single quotes right next to each other). You'll only be

able to use DRAWTREE on the current drive, beginning at the root directory. -Charles Petzold

(Figure 1 continues)

```
(80512 p512)
program drawtree ;
type
   dterec = record
                  reserved
                             : arrey [1..21] of cher ;
                             : byte ;
: array [1..4] of integer ;
: arrey [1..13] of char ;
                  other
                  neme
    regrec = record
                  ex,bx,cx,dx,bp,si,di,de,ee,flage: integer :
   end ;
etring64 - string [64] ;
   dte
              : errey [1..32] of dterec ;
    req
    nemestr : etring [13] /
procedure cetdta (level: integer) :
   begin
       reg.ex := $1A00 ;
       reg.dx := ofe (dta [level]) ;
reg.ds := aeg (dta [level]) ;
       intr ($21, req);
```

Figure 1: A Turbo Pascal DRAWTREE program that displays a treelike listing of the various subdirectories on a hard disk.

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■ POWER USER

```
function findfirst (seerch: string64 ; level: integer) : integer ;
        setdta (level)
        reg.ax := $4E00 ;
reg.cx := $0010 ;
        reg.dx := ofs (search) + 1;
        reg.ds := OES (Search) +
reg.ds := seg (search) ;
intr ($21, reg) ;
        if ((reg.flags end 1) = 0) then findfirst := 0
else findfirst := reg.ex ;
function findnext (level: integer) : integer ;
    begin
        aetdte (level) ;
         rag.ex := $4FEE;
intr ($21, reg);
        if ((reg.flegs end 1) = 0) then findnext := 0
else findnext := reg.sx ;
function listdir (seerch: string64 ; level: integer) : integer ;
    var i, retcode : integer ;
        retcode := findfirst (concat (search, '\*. *'#8), level) ;
        if retcode = 18 then listdir := 8 else if ratcode <> 8 then listdir := 1 else begin
            repest with dte [level] do begin
if (ettr = $10) end (nemeil) <> '.') then begin
                    namestr | 6) := 613 ;
for i := 1 to 13 do namestr |i] := name [i] ;
                    nemestr [6] := chr (poa (66, nemestr) - 1) ;
namestr := concat ('\', namestr) ;
                    for i := 2 to level do write (*
                    writeln (namestr) /
                    retcode := listdir (concat (search, namestr), leval*+ 1) ;
                end ;
            end ;
end ;
until (findnext (level) = 18) ;
            listdir := 0 ;
         end
    end ;
if listdir (paremetr(1), 1) = 1 then writeln ('Incorrect parameter') ; end .
                                                                                (Figure I ends)
```

OUTLINING IN WORDPERFECT

One of the advantages of selecting Word-Perfect an word processor it the case was. If find it is best to this which you can use it for outlining. The program includes a temporary left margin to be the processor of the column as the left margin until yout his fleet re out it, it will go over your left with the processor of the processor of the total the processor of the When it is used in conjunction with the left to example the processor of the processor of the processor of the When it is used in conjunction with the left to example the processor of the processor of the processor of the way that the processor of the processor of the processor of the transport of the processor of the processor of the processor of the transport of the processor of the processor of the processor of the transport of the processor of the processor of the processor of the transport of the processor of the processor of the processor of the processor of the transport of the processor of the processor

To start, press "temp left mar," then press "left mar rel," type "l.", and hit Tab. Your text will then line up at the new margin. For a subpoint, press "temp left mar" twice, then "left mar rel' once, type "A.", and then Tab. For a sub-subpoint oress "temp left mar" there times. "left thar relimes."

mar rel" once, numbering and tabbing in the same way.

I find it is best to "temp left mar" over to where the text of the item is to begin, then back up to enter the letter or number. This attaches the number notation to the item so that if there's editing to be performed later, the number moves along

Marty Flowers
Weirton, West Virginia

Yes, your procedure does seem to work quite well. I must assume that you're using WordPerfect Version 3.0 or earlier, since Versions 4.0 and 4.1 already contain a flexible outliner. An even faster way to implement an outline format, however, is to create a WordPerfect macro named under an Alt-alba definition that evokes varying

An even faster way to implement an outline format is to create a WordPerfect macro that evokes varying levels automatically.

levels automatically. Simply define and name the macro, execute the temporary left margins talko called indent), left margin release, the number, and then the tab. Then end the macro. You can even chain a number of these macros together to look for a carriage return before executing the next macro. This way you can enter a sub-topic and have the next sub-subtopic created eigher you his Return—Dawn Gordon

A PSEUDOCOMPILER FOR dBASE II

Too often, dBASE II command file writers are disappointed with the speed at which their lengthy programs run, especially with large data files. Many times, this degradation in speed occurs because of the way in which the application was programmed, not because of an increase in the number of records in the files. One good way to improve the speed at

which a program executes is to limit the number of STORE and REPLACE commands used. dBASE must access your disk every time it encounters one of these commands. Therefore, changing your code

```
from

STORE ' ' TO mione
STORE ' ' TO mithee
STORE ' ' TO mithree
REPLACE one NITH mione
REPLACE two NITH mithree
To read
```

STORE ' 'TO mione, mitwo, mithree
REFLACE one WITH mione, two WITH mithree
instead, will dramatically limit the number
of disk accesses, speeding things up con-

***COMPILE NOW Authors 2, Now Mennion *** Populars COMPILE, ON file.

***New 11 235 to the executes in locath.

EXT COLOR OFF
EXT TOLK OFF
EXT TOLK

siderably.

Figure 2: A dBASE II pseudocompiler that speeds program execution.

ENDIF SKIP

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POWER USER

Because of dBASE's interpretive nature, such things as blank lines, comments (lines starting with *), and the indenting of program lines also slow a command file's execution times. However, eliminating all these items from your program may be more trouble than it's worth if you must later rewrite or debug your program.

into the wine to decopy out [fittings in a proposed of the proposed of the proposed of the prosedent of the proposed of the proposed of the prowill like you or proposed and strip all bland and comment lines from it while left-justilying all code. It produces a second version of your code with all con the end of the original name, which you can use in place of your original. Your original program is left intact for documentation, debugging, and other purposed.

J. Ron Menning Alliance Ohio

Regular readers of PC Magazine's Power User column will recall the dBASE speed

One good way to improve the speed at which a program executes

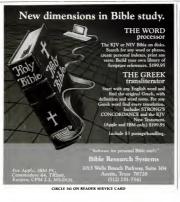
is to limit the number of STORE and REPLACE commands used.

tips that have appeared in earlier issue, Mr. Menning's slick routine automatically adjusts your existing command files to take advantage of many of these tricks, while leaving your original programs untouched. Though Figure 2 shows COM-PILE_PRG exactly as submitted (with indentations, comment lines, and so forth in place), you might just want to run its code through itself to make it run faster. Be sure you have a data file called COM-PILE.DBF (consisting of one character field 254 bytes in length) on your disk before running COMPILE.PBG.

One word of caution, though. For some reason I can't figure out. COMPILE. PRG strips away semicolons at the end of each line of code that is continued on the next line. Therefore. I suggest you go through the 'compiled' version of your code and replace the missing semicolon on any partial lines remaining in the program.—David Obressing.

PUTTING ON THE BRAKES

WordPerfect's macro facility contains an undocumented feature that allows you to slow down macro execution at any point and to change speeds as often as you like. This feature has numerous uses, such as





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nications and printing. Ali EuroLAV operations may be started from any connected PC. Printer sharing operates transparently with

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■ POWER USER

pausing to view a screen of information before continuing, structuring macros for presentation, and creating demos.

While defining your macro, simply press Ctrl-PgUp, a number, any key, and then continue the macro definition. This inserts the code 00 hex (followed by a number byte) into the text. When Word-Perfect reads this code, the number dictates the speed; the higher the number, the slower the execution. The default setting is 0-very fast (too fast, in fact, for some applications). If you have several pages of Congratulations! SSI confirms that this

text, for example, they will fly by so quickly you won't see anything but the final screen. Generally, numbers ranging from 0 to 10 will fit most needs.

To demonstrate the potential effects. just enter the lines shown in Figure 3 and run the macro by typing Alt-F10 and then hit Enter. I'm sure you'll agree: this feature breathes new life into your macros. Victor Boc

Santa Cruz, California

er, deleted from Version 4.0. The funny thing is that I had called SSI asking if there was a way to pause or slow the macros down. A macro for getting to the printer menu and then issuing a GO command was fouled up because my macro was just too fast. Thanks for the tip, which works wonderfully.-- Dawn Gordon

feature is, in fact, possible using WordPer-

fect, Versions 3.0 and 4.1. It was, howev-

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Ctrl-PgUp <2><8> <enter>
*SLOWNWW. *
Ctrl-PgUp <2> <enter>
*And this is * Ctrl-PgUp (#) (enter)

Ctrl-P10 (enter> Ctrl-PqUp <2> Center> "This is

to define a macro to select a moderate apeed to select a speed of 28 to return to apeed 2

select default speed of 8 to end the macro definition

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thing you haven't saved in memory. How-

ever, as Mr. Stahl notes, UNCRASH

doesn't get along at all with BASIC. To test

USER-TO-USER

PC Magazine's readers share their favorite tricks for getting the most horsepower out of DOS. BASIC, and their systems in general.

BACK FROM THE ZONE

If you've ever found yourself hopelessly locked inside an infinite loop, you've probably experienced the frustration of having to reset your computer to get out of it. This can be especially distressing when you're using a volatile RAMdisk and the most recent version of the program that caused that infinite loop evaporates with it. You might think that hitting Ctrl-Break will get you out of such a situation, but this works only if a DOS function is called during the loop. UNCRASH.COM, created by the UNCRASH.BAS program in Figure 1, cures this problem.

The IBM PC executes an interrunt about 18 times a second to update the time kept current by DOS. The BIOS routine that performs this service also performs another interrupt, called the Timer Tick at ICH, that allows other applications, such as a print spooler, to gain control at regular intervals. UNCRASH takes advantage of this DOS feature; it loads its own address into the location called by the Timer Tick interrupt and gets control 18 times a second. When the Ctrl-Break key is pressed. the BIOS keyboard interrupt servicer sets the highest bit of byte 71H in data segment

When UNCRASH finds this bit set, it resets the high bit at 71H to zero, sends an end-of-interrupt signal to the interrupt controller at Port 20H, and causes the application to terminate by calling DOS function 4CH. UNCRASH saves and passes control to the address that was previously located at Interrupt ICH, so it shouldn't preempt any other programs that use this service. Although UNCRASH works well with all the software I use, it will not work in IBM BASIC and will cause the machine to hang if it is used while in BASIC

how well the program breaks out of an as-Neil Stahl sembler routine, before you load UN-San Francisco, California CRASH, create a tiny endless assembler loop called ENDLESS.COM by getting This sure beats tearing your hair out and into DOS and putting DEBUG on your hitting the big red switch and losing everydisk and typing the following:

```
188 'UNCRASH.BAS -- creates UnCrash.COM -- by Neil Stahl
118 OPEN "uncrash.com" AS #2 LEN=1:FIELD #2,1 AS C$
128 READ CHRIF CHR=-1 GOTO 218 ELSE READ FS:SUM=8
138 IF FS="-1" GOTO 218 ELSE REPEAT=LEN(FS)\2
148 FOR I=1 TO REPEAT
150 PL=(I-1) *2+1:B$=MID$(P$,PL,2)
168 SUM=SUM+VAL("&h" +B$) *I:LSET C$=CHR$(VAL("&H"+B$))
178 PUT #2.ST+1:ST=ST+1
188 NEXT
198 IF CHK=SUM THEN 288 ELSE PRINT "error in line"; DS+228
200 DS=DS+10:GOTO 120
218 PRINT "uncrash.com created": END
228 DATA 3564, E82D88CB1E58B848
238 DATA 3469,888ED8A871882C88
248 DATA 4285,758FA27188B828E6
250 DATA 4360,20581FFBB44CCD21
268 DATA 2499, CF581F2EFF2E2881
278 DATA
             0,000000000000000000
288 DATA 3883,581EBF88885758FA
298 DATA 2847, B827884581B88888
300 DATA 4320,8ED8BB7000C43F8C
318 DATA 2661,C88ED82E893E2881
328 DATA 4118.8CC82EA32A818CC8
338 DATA 3841,8 EC82E8D3E8481B8
348 DATA 3993,88888ED8BB788889
358 DATA 3585,3P8CC7897F822E8D
368 DATA 2188,163881FBC3
```

Flaure 1: Program to create UNCRASH.COM, which, once loaded, will stay resident in memor and prevent an endless loop from hanging your system. Note: Do not use this at the same time as or before you use BASIC or BASICA.

378 DATA -1

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rcx 3

Be sure to hit the Enter key at the end of every line, especially the one between JMP 100 and RCX, and the final a, Run it by typing ENDLESS and try to break out of it by hitting Ctrl-Break. After satisfying yourself that it can't be done, switch your system off and on again, and run UN-CRASH.COM. Then run ENDLESS, and you'll see that you can indeed Ctrl-Break to safety. However, don't leave UN-CRASH in memory and later load BASIC. or you'll crash. The moral, of course, is save everything early and often.

SUBDIRECTORY SHIFTER

One of the best features of DOS Versions 2.0 and higher is tree-structured directories. However, DOS provides no automatic way to move a file from one subdirectory to another other than by manually copying it to the new subdirectory and then deleting it from the old

The RETREE.BAS program in Figure 2 creates a file called RETREE.COM that will do this for you automatically. RE-TREE accepts filenames that have different paths. If the filenames differ, the file will be renamed. The format to use is as follows:

RETREE [d:[[path][filespec] [filespec]

Only one file can be renamed at a time so you can't use wildcards. If a file you want to RETREE is outside the current default subdirectory, you must specify the full drive, path, and filename.

Gary Collins

Annandale, Virginia 188 'RETREE.BAS -- by Gary Collins

110 SCREEN 0:WIDTH 80:KEY OFF: DEFINT A-2:DIM TOT(15) 128 PRINT "Checking DATA, please wait..."

130 FOR A=1 TO 15:READ B:TOT(A)=B:NEXT

148 FOR A=1 TO 15:FOR B=1 TO 18:READ C: Z=Z+C:NEXT

150 IF TOT (A) = 2 THEN 170 168 PRINT "Error in line"; A*18+238; "-- redo. ": END

170 Z=0:NEXT:RESTORE 240 180 OPEN "retree.com" AS #1 LEN=1

190 FIELD #1,1 AS D\$

200 FOR A=1 TO 142:READ E:LSET D\$=CHR\$(E):PUT #1 210 NEXT:CLOSE:PRINT "retree.com created"

228 DATA 1819,839,1281,1128,1217,885,957

230 DATA 931,939,501,929,970,969,986,46 240 DATA 43,201,138,14,128,0,128,249,0,118

250 DATA 44,187,130,0,128,63,32,116,8,131 268 DATA 195,1,226,246,235,29,144,198,7,8

278 DATA 138,14,128,8,139,249,198,133,129,8

280 DATA 0,186,130,0,139,251,131,199,1,180

290 DATA 86,205,33,115,7,186,63,1,180,9 300 DATA 205,33,195,13,10,70,111,114,109,97 318 DATA 116,32,111,114,32,182,185,188,181,118

320 DATA 97,109,101,32,101,114,114,111,114,46

330 DATA 13,10,13,10,82,69,84,82,69,69 340 DATA 32,91,100,93,91,112,97,116,104,93

350 DATA 91,102,105,108,101,110,97,109,101,46

360 DATA 101,120,116,93,32,91,102,105,108,101 370 DATA 110,97,109,101,46,101,120,116,93,13

380 DATA 10,36,0,0,0,0,0,0,0,0 Figure 2: Program to create RETREE.COM, which can move files from one subdirectory to

another. To use this, log into the target subdirectory and type RETREE [d:] [path] [filespec] [filespec]

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USER-TO-USER

This works by using function 56H of DOS Interrupt 21H. While it is far handier than slogging through the whole process manually, it can't handle more than one file at a time and can't move files across different disks. But it can rename files while moving them, and this process is sorely needed in DOS

COLOR SCREEN TRICKS

BASIC's OUT command lets users send data directly to their computers' ports and really take control of their systems. The SCRNTRCK.BAS program in Figure 3 creates two interesting screen effects on IBM color graphics systems (CGAs only!) that I call rocking and scrambling.

Rocking (choice 1 on the menu) moves the screen from side to side, and then up and down, and finally in a random pattern. Hitting any key switches the direction of movement. Scrambling (choice 2) 188 ' SCRNTRCK.BAS -- by Ed Halbart (Requires IHM Color Graphics) 118 PAUSE-S8:ON ERROR GOTO 368

218 *** Rocking: Vartical Movement ***
228 FORT-7:FOR B-26 TO 38:GOSUB 318:NEXT B

236 FOR B=36 TO 26 STEP -1:GOSUB 318:NEXT E IF INKEYS-" THEN 228 ELSE B-4H1C:GOSUB 316

248 F. MERTS-" THE 228 EASE D-ALICOSOME 318 MORNING COMMENTS AND A STATE OF THE PROPERTY OF TH

328

OUT 483D4, PORT-100T 483D5, 8:FOR DELAY-1 TO PAUSE:NI "** Screebling "* CLEIFLIES:FOR A-1 TO 68:00T 483D6,1:00T 683D1,A FOR ** SENSHART:REAT-160T0 128 OUT 483D6,1:00T 483D1,89 OUT 483D6,1:00T 483D1,89 ROTE 48:FURTE 88:COLOR 1,7,3*CLB:ON ERROR GOTO 8 348

Figure 3: SCRNTRCK (for IBM color systems only) that programs the 6845 chip directly for some interesting screen effects. Be sure to save the program before you run it the first time.

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USER-TO-USER

changes the number of columns on screen. which makes whatever is currently on the screen "march" from seeming randomness into order.

Since playing with OUTs can have unpredictable results, type the program in carefully, and make sure you save it before you run it.

Ed Halbert Manassas, Virginia

OUTing to the 6845 chip can easily produce interesting effects like these, or put more than 25 lines on your screen, or do many other attention-getting tricks. But be careful. These were tested on several IBM color graphics systems; try them on other hardware at your own risk! If the unexpected does happen with this program on an IBM color graphics system because of a typing mistake, try recovering your normal screen by typing RUN 360.

SILENCE ISN'T GOLDEN

Like many PCs, my AT&T PC 6300 has no audible or tactile feedback for the autorepeat capability of the keyboard. This isn't usually much of a problem unless my mind wanders and I forget to release a key away a healthy portion of a file in an editor. The KEYCLICK BAS program in Figure 4 creates KEYCLICK.COM.

which solves the problem. When run the first time, KEYCLICK .COM replaces the interrupt vector for the as I'm typing. A goof like this could delete keyboard I/O routine with its own address

	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
100	'KEYCLICK.BAS (Creates KEYCLICK.COM) By Michael McGuffey
110	OPEN "KEYCLICK.COM" AS \$1 LEN=1:FIELD \$1.1 AS BYTES
	READ DS:IF DS="-1" THEN GOTO 168
	BEXVAL=VAL("&H"+DS); LSET BYTES=CHRS(BEXVAL)
	CHKSUM=CBKSUM+BEXVAL:BYTENUM=BYTENUM+1
	PUT#1, BYTENUM: GOTO 128
	IF CHESUN-18639 THEN 258
	PRINT "DATA ERROR CBECK AND RERUN": CLOSE: END
	DATA EB.47.98.51.58.E4.68.3C.1D.74.36.3C.2A.74.32.3C
	DATA 36.74.2E.3C.38.74.2A.3C.3A.74.26.3C.45.74.22.3C
	DATA 46.74.1E.24.88.75.1A.PA.E4.61.8A.E8.24.FE.E6.61
	DATA 8C.82.86.61.89.38.88.82.FE.24.FD.86.61.8A.C4.86
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	DATA 89.1E.45.01.8C.06.47.01.BA.03.01.B0.09.B4.25.CD
	DATA 21.BA, 49.61, PB, CD, 27,-1
250	PRINT " KEYCLICK.COM CREATED CLOSE: END

Figure 4: Program to create KEYCLICK.COM audible key click generator.

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and stores that vector for future use. It then terminates but remains resident in memory. From that point on, every time a key is pressed the keyboard interrupt causes KEYCLICK to execute. KEYCLICK checks the I/O port to see which key is pressed. If it is not the scan code for the Shift, Ctrl. Alt. or Lock keys, it sets up the speaker port and clicks the speaker. (Note: KEYCLICK also checks to make sure the keyboard sent a "make" code. When a key is released, the keyboard sends a

■ The AT&T 6300 is one. of the more reasonable IBM PC clones, but nothing comes close to the wonderful IBM keyboard.

"break" code, which is the scan code sent when the key is pressed, ORed with 80h. If this is the case, the speaker is not clicked.) The routine then JMPs to the normal keyboard handler, and everything executes as normal. I have not tested the program extensively on the IBM PC, but it seems to run without any errors.

Michael McGuffey Huntington, West Virginia

It is handy to have both tactile and audible feedback, and this does a good job at providing at least one of these, although it will have trouble vying for interrupts with other memory-resident programs such as SideKick. The AT&T 6300 is one of the more reasonable IBM PC clones, and its keyboard is better than most, but nothing comes close to the wonderful IBM keyboard (especially its implementation on the AT).

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; Jump to initialization

; Place to store old vector

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DON'T PRINT THAT

I've found many of the hints and patches in PC Magazine very useful. One in which I'm particularly interested is the PRTSCR. program (User-10-User, PC Magazine, Volume 3 Number 20), which disables the Shift-PThSC function so the computer doesn't hang if a printer is not attached. However, hitting Shift-PThSC only causes a temporary hangup; hitting Crit-PThSC on the DOS command level is far more disastrous. Could you provide a solution to both problems?

Alan J. Rubin Columbus, Ohio

Under DOS 3.x., Ctrl-PrtSc is not the problem it used to be. I've found it easy to recover by hitting Ctrl-PrtSc again, then hitting a bunch of other keys until DOS comes to its senses. When it finally prints the "Abort, Retry, Ignore?" message, just press A.

Until you upgrade, however, you might try the NOPRINT.COM program shown in Figure 1. You can create the command with DEBUG. This program works a little differently from the one presented in the User-to-User column that you refer to in your letter. That program disabled Interrupt 5, which is the print-screen interrupt. Ctrl-PrtSc is interpreted by DOS and works quite differently from Shift-PrtSc, however, so I had to intercept the keyboard Interrupt 9. Since other resident programs often intercept Interrupt 9 as well, it's not as easy to provide an on/off feature, so NOPRINT.COM cannot be turned off unless you reboat. If you don't

-A				
XXXX:8188	JMP	912F	,	Jump to initialization
XXXX:8182	DW	8888 6688	i	Place to store old vector
XXXX: 9186	STI		i	New Interrupt 9
XXXX:8187	PUSH	AX	i	Save AX
XXXX:8188	IN	AL, 68	i	Get scan code of key
XXXX: 818A	CMP	AL, 37	i	See if it's PrtSc
XXXX: 818C	JNZ	8129	ï	If not, go away
XXXX: 818E	MOV	AH, #2	i	Now get shift states
XXXX:0110	INT	16	,	from BIOS
XXXX: 8112	TEST	AL. 07	÷	See if Shift or Ctrl
XXXX: 8114	JE	8129	ï	If not, go away
XXXX:8116	IN	AL, 61	i	These instructions
XXXX: 9118	MOV	AH, AL	i	reset the keyboard
XXXX; 811A	OR	AL, 88	-	
XXXX: 811C	OUT	61, AL		
XXXX: 011E	MOV	AL . AH		
XXXX: 8128	OUT	61.AL		
XXXX: 8122	CLI		,	Disable interrupts now
XXXX: 8123	MOV	AL, 28	i	These instructions
XXXX: 8125	OUT	28.AL	ï	react interrupt controller
XXXX:8127	POP	AX	i	Get back AX
XXXX: 0128	IRET		i	Return to where we came from
XXXX:8129	POP	AX	i	If not PrtSc keys
XXXX:012A	CS:		i	Go to real Interrupt 9
XXXX: 912B	JRP	FAR [8182]		
XXXX: 812F	MOV	AX.3589	,	Entry: Get Interrupt 9
XXXX: 8132	INT	21	į,	vector through DOS
XXXX: 8134	MOV	[8182],BX	,	Save the offset
XXXX:8138	MOV	[8184],ES	,	and the segment
XXXX: 813C	MOV	DX,8186	1	New Interrupt 9
XXXX: 013P	MOV	AX, 2589	,	Set the vector
XXXX:0142	INT	21	,	through DOS
XXXX: 0144	MOV	DX,812F	,	Past resident part
XXXX:0147	INT	27	ï	Terminste, stay reaident
XXXX:0149				
-R CX				
0000				

8888 8888

Figure 1. Yau can use DEBUG to create NOPRINT.COM, a program that remains resident in memory and disables the Shift-PriSc and Cirl-PriSc key combinations.

:8849 -N NOPRINT.COM

Writing 8849 bytes

■ PC TUTOR

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CIRCLE 232 ON READER SERVICE CARD

have o printer ot oll, that should not be o problem,

If you like the onloff feature because you have a printer but usually leave it turned off, you con continue to use the eartie program and simply change the line ot offset 0112 in NOPRINT. COM to TEST AL,OH. NOPRINT will then test only for Curl-Prisc. If you need to echo something to your printer. Curl-P also works in DOS for printer echoing and will continue to work with either version.

You don't have to type the semicoloned comments; DEBUG ignores them. They are there to explain what's going on.

Reoders interested in writing residem routines that do things with the keyboard might toke note of the code necessary to get the scon code from the keyboard controller (or offset 1018) ond how to reset the keyboard controller once you're old done with it between offset 0116 and 0126). Notice that you reset the keyboard only when you don't want the normal BIOS routine to process the key.

CHEAP CHIPS

In the advertisements in the back pages of PC Magazine, I often see low-cost memory chips (typically 576K bytes for less than \$10) to be user-installed on existing boards. Are such inexpensive memory chips "factory seconds" or what? Can they be trusted? What should be considered before installing such chips?

> Wellington Lee Chicago, Illinois

Memory chips for the IBM PC-XT ore often sold in sets of nine. These are 416t dytamine-immory chips, and eoch one constore 64K bits. You need nine of them to got 64K bytes of morrow; eight for the to bits and one for the parity check. A set of mine chips for less ban \$10 provides with with 64K bytes of odditional memory, however, rather than the 576K bytes suggest. (576K bytes would be nine banks of nine chips for less than \$100.)

The current low cost of these chips is typical of mass-produced integrated circuits. The production process itself is cheap. Once initial-development costs are paid off ond other manufocturers are producing the chips, the prices plummet. To illustrate this, I dug into my back issues of the control of the chips.

vorious computer magozines ond put together the following table, which shows an estimated overage retail price for 4164 chips in single quantities:

ele quan	uties:	
1980:	\$175.00	
1981:	50.00	
1982:	15.00	
1983:	7.50	
1984:	5.00	
1985:	1.00	

In 1980, a 576K-byte expansion board using 4164 chips would have cost over \$10,000! In the yeors othead, you may see these chips drop to the 50-cent level, but they probably won't go much lower than that

As of his writing, there is olso some indication that the prices may be ortificably low becouse of "dumping" by depances the manufacturers. These manufacturers chip manufacturers out of business. Since the Japances of breathy dominate the beta Japances of breathy dominate the beta Japances of budffeut. In one 256K hyse memory chip markets, which should no be difficult. In one of the other problem for the Commerce Department and the there areasing Trade Commission of the Commerce Department and the forest containing Trade Commission of the Commerce Department and the there are unfortable Commission of the Commerce Department and the threat minimal Trade Commission of the Commerce Department and the threat would be desired to the Commerce Department and the Department of the Commerce Department and the Department of the State Office of the Department of the Departme

There is no indication that these chips ore substandard in ony way. Consequently, there should be no problem with buying o 64K-byte memary-expansion set of nine chips for less than \$10. But be awore of o few possible hitches.

The 4164 chips one owitable in different occess predict, most commonly 120, 150, 200, and 300 numoscents (new). The speed is sausly obbeviated nickey). The speed is sausly obbeviated 120 and 150 nxec) or more 150 nxec. The fusier chips 120 and 150 nxec) ore more expensive. Chips insolided in the 18th PC shauld be roud at 200 nxec or fusier. Generally, the sex of 200 nxec or fusier. Generally, the state of the product of the 150 nx 200 nxec conds, that is help to see it soudd right in the advertisement. Con you get a set of but white? Yes,

you can. I certointy have. But price seems to have little to do with it. Over a year ago, I bought a very popular, fully populated 384K-byte multifunction boord from o well-known and reputable mail-order distributer. The board and memory usually work fine, but so for I've had to replace

15 of the 54 chips on the board. (I should add that my PC is left on 24 hours a day.) The first time one of the chips failed, it took me an hour to replace it, but I've now gotten the routine down to less than 5 minutes.

None of the replacement chips I've put in—all purchased at bargain prices—has ever falled. Nor have any of the 36 64Kbyte chips on my system board, purchased at IBM's outrageously high prices. In my experience, then, there's no relationship between price and failure.

convere pie camp jamer. To a will have more physical difficulty replacing chips on a system board than on a system board than on a system board than on a separatish obach, so if you knee chips you are bouing, put them on an expansion board. If your PC is still under warramy with IBM or if you toke out an IBM service contains you may wont to put only IBM-purchased chips on your system board because you'll have to remove "foreign" chips before IBM will service your machine.

What happens when a chip fails and how can you fix it?

If the PC is on when the chip expires, you'll get a sudden 'Parity Check' message on your screen. This will be followed by a 1 if the problem came from the system board or a 2 if it's from an expansion board. (The PC AT provides more detailed information.)

The "Parity Check" message occurs whenever the PC reads a byte from memory and the sum of the eight data bits does not agree with the parity bit stored in the minth chip. Murphy's Law states that parity check errors will occur right when you're about to do a hig save, but in reality, chips fail more often the mament the PC is torned in

is turned on. After a parity check error occurs, you'll have to turn your machine off and back on again. If it successfully boots, you may simply have hit a sporadic problem, like a line surge, static electricity, or even something unrelated to the memory. But if the BIOS again gives you a "message" that begins with a string of numbers followed by 201, you probably have a dead chip. The four hexadecimal digits that precede the 201 are very important because they pinpoint the exact chip that failed. (On a PC, the machine will boot, and you'll get an instant "Parity Check," which overwrites the 201 message, so you have to

look fast. On an XT, the message is not

overwritten.)
The first two hexadecimal digits specify the upper byte of the 20-bit address of the memory chip that failled. If you have a PC with 256K bytes on the system board and 384K bytes on an expansion board, an address of OD means the first bank of chips on the system board and 10 means the second bank. The number 40 means the first bank of chips on the expansion board; 90 is the last bank on the expansion board; 90 is the

uast bank on me expansion oboard.

The second two hexadecimal digits contain a 'bit mask' that shows exactly which chip (or chips) failed. A Ol means bit 0, Oz means bit 1, Ot means bit 2, and 80 means bit 7, A Ol means that he ninth chip, which is used to detect parity errors, is itself the bad one. (Expansion-board manuals usually contain diagrams that will help with this, and the article 'Circuit Board Home Remedies,' by Gene B. Williams, in PC Magazine, Volume A Vumber

6, may also be useful.) Once you determine the location of the chip that failed, take out the expansion board, replace the chip, and try turning on the machine again. You'll wont to delay bolting the cover down until you know

your replacement works.

I've found that data losses due to faulty
chips are minimal. The 15 chip failures
I've experienced have all occurred have all occurred
when the machine was turned on or or
though this doesn't quite make service or med during the inevitable system crashes
that happen when testing new assume
language programs. Since I seem to have a I
bush of I'mne bombs' in my machine
Light seem to have a common to the control of the control
light keep extra chips around and really
don't worry about not work to the control
light keep cut to chips around and really
don't worry about not

In conclusion, \$10 is about the going price for a set of 64K-byte chips. If you're suspicious about the quality of the chips, put them on an expansion board and put chips you're sure of on the system board. You might try buying sets of chips from several different retailers and keeping a few spares on hand for emergency replacements.

The PC Tutor solves practical problems and explains points of general interest. To see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016.

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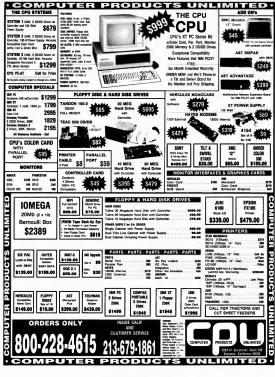
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REVIEWS IN BRIEF

Enhancing Your DOS Viewing Environment: Scroll & Recall

BY BRAD STARK

BT BRAUSTARK
How much time could you save every day if you could only get back to he display you had on your computer secren just a moment ago? If you've ever tried to compare two files or have scrolled through a report and had a couple of lines run off the screen he-fore you've read them, you know exactly the kind of furstration that Seroll & Recull is designed to eliminate.

Scroll & Recall is a screen! to

Just type SR either at the DOS prompt or into your AUTOEX-EC. BAT file. A fler that, whether you're in DOS or in an application program, hitting Ctrl-Space bar interrupts the PC's normal operations and puts you in the program's Scroll function. You use the number paid to scroll backward into your screen's past. Touch the Ese key, and you're back to the pre-

The program's Recall function continously stores the DOS you're doing something complicated and want to remember just how you succeeded (or failed), you'll be tempted to call this feature "S-SAVIOR." You can customize Scroll &

You can customize Scroll & Recall to fit your needs and available memory. The default setting consumes 18K bytes of RAM, of which 8K bytes is Scroll memory (4 screens = 100 screen lines) and 500 bytes is Recall memory. If your system's memory total can support it, you can alter this to store up to 28 screens in Scroll memory.

(each takes 2K bytes).

Scroll & Recall is easy to learn, quick and easy to use, and completely transparent the rest of the time. If you're a heavy computer user, it can save you a

lot of keystrokes and frustration. It's become one of only two utilities I include in my standard AUTOEXEC.BAT.



Scroll & Recall Opt-Tech Data Processing P.O. Box 2167 Humble, TX 77347

(713) 454-7428 List Price: S69 Requires: 64K RAM, one disk drive, monochrome or graphics

screen used in 80-column mode. CHICLE 630 DN READER SERVICE CARE

keyboard utility that lets you scroll backward to view the contents of previous display screens as easily with a database or spreadsheet program as with your favorite word processor. In addition, it lets you recall DOS commands (or other keyboard input) and edit or reissue them without retyping. Whenever you need to see what the screen under some program of the program worth—Scroll & Revall is right worth—Scroll & Revall is right.

The program is a snap to use.

commands or other keyboard input, letting you recall previously entered data lines, edit them, then reenter them with the touch of a few keys. Alternatively, you can edit previously issued commands using the PC's function keys.

Still a third part of the Seroll & Recall program, called S-SAVE, lets you automatically create a text file of the current Scroll memory. When something goes wrong and you need a record of what happened, or if

Opt-Tech Sort: Blinding Pace. Budget Price

BY BRAD STARK

Rapids sorting of data into any order needed and the ability to emerge similar sets of data into a single file for processing are absolute requirements for productive data management. While programs such as dBASE and I-2-3 have sorting capabilities, they're not grey hounds for speed, if you work with data supposed. If you work with data reason to be a supposed of the processing of the processing the programs to schedule sorts around lunch breaks to give these programs time to digest your data.

A slick utility called Opt-Toch Sort gives you an alternative way to sort or merge data. For one thing, it's lightning fast: 9 to 25 times faster than the DOS SORT utility and about five times quicker than even dRASE IIP's much-touted Sort. It's also very flexible, capable of handling record lengths of up to 5,000 bytes, sorting as many records as you can fit onto your disk. Both fixed- or variablelensth records are allowed, and merged at one time. Opt-Tech Sort works with ordinary ASCII text files, and it is directly callable from IBM BASIC, BA-SICA, Compiled BASIC, CO-BOL. Pascal, assembly language, mbp COBOL, and dBASE II. Software interfaces are available for RMCOBOL, MicroFocus COBOL, Realia COBOL, MicroFocus COBOL, Realia COBOL, MicroFocus COBOL realia

for release shortly

up to ten different files can be

You can issue the software's sort/merge command statement either in one command line or by following a step-by-step menu. For programmers, the command statement can also be passed as a parameter or read from a file, and the entire utility can be called into play by a DOS batch file or as a subroutine from supported higher-level

I found the Opt-Tech Sort's user interface to be particularly well done. The 70-page documentation is clear and is replete with examples. Don't be alarmed by its length it is divided into sections and appendixes for each different file type you might use, so you can go directly to the section you want and skip the rest. And as an extra touch—much appreciated, thanks!—the disk includes a DOS demonstration that contains practice files as well as sample data to the contains practice files as well as sample data. This one's definitely a best buy.



One Step at a Time: Pop-Up DeskSets

BY DAVID OBREGÓN

RAM is cheap. It has become so cheap, in fact, that few software producers today feel a need to shochorn their products to run under the once-supreme 64Kbyte high-water mark of a few years ago. In RAM-resident software especially, the trend is to put everything you can possibly think of into one large chunk of RAM. Today's RAM-resident macro processors include complex DES encryption and fancy window programming facilities, while desk organizers include full-featured word processors and database managers, and everything duplicates access to the same basic DOS functions-whether you need these things in memory at all times or not. Often, this can mean you run out of RAM space for that all-important 1-2-3

worksheet just when you really need it.

Pop-Up DeskSet from Popular Programs Inc. has approached this two-sided situation from a modular viewpoint, giving you as many functions and features as you need for your work, without causing you to give up RAM space for functions you may never require. Each Pon-Up function-word processor, calendar, alarm clock, two different calculators. DOS accessor, and phone dialer/telecommunications control, as well as a wonderful little number called Pop-Up Anvthing-is an independent program that you can load into memory or not. The choice as to what functions you need is vours, not some programmer's. New Pop-Up functions can be added at any time. Considering how important RAM is for those

applications that actually help you do your job, this approach makes a great deal of sense. The basic package, Pop-Up DeskSet, includes PopDOS.

which accesses ten DOS commands from within an applications program, including one of its own-XDIR-which provides a very useful directory listing showing the first 26 or so characters in that file: Pop-Up Word, an extraordinarily fullfeatured notepad able to create. save, and retrieve files, cut and paste text between files, and insert text into an application; Pop-Up Calendar, which displays 3 months at a time onsereen, shows national and religious holidays, and can be easily switched to display a single month in full-screen format with user-defined notes for dates; Pop-Up Calculator. which provides a printable running tape of arithmetic operations; Pop-Up Financial Calculator, a specialized business-oriented calculator that solves compound interest and discounted cash flow problems and performs simple statistical analyses, annuity calculations, and more; and Pop-Up Alarm Clock, which has six separate alarm settings that flash remind-

Then there's the pearl of the package, Fop-Up Arathing, which allows you to interrupt an application, jump to DOS or any other applications you may suddenly need regardless of subdirectory conflicts, then return to the point in your original application exactly where you left ii. Pop-Up Arathing alone may be worth the cost of the entire package if you lend to use the package if you lend to use gram in the course of your working day.

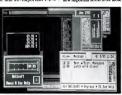
er messages on-screen.

If you own a modem, Popular Programs Inc. offers a second package—Pop-Up Det&ter Plus—that also includes Pop-Up Voire, a handy phone disler accessible from within an application, and Pop-Up Modem, a telecommunications program that lets you access on-line commercial database, retrieve electronic-mail messages or other data, and insert this data directly into your application. Taken to pether, it's a stargering range of functions. More important, each function stands up well when compared with all-in-one desk organizers like SideKick or Homebase. Indeed, in some cases (like the calendar, the two calculators, and the notepad), the Pop-Ups offer more functionality than their SideKick equivalent, with less memory penalty.

Unfortunately, all memoryresident software seems to assume that it's the only thing you'll ever need to load into memory. Thus there are inevitably going to be conflicts with other RAM-resident programs you may currently be using. such as a macro processor or screen saver utility. Pop-Up DeskSet's documentation devotes more space to these potential conflicts than is commonly found in RAM-resident software, perhaps because the designers had to figure out how to keep the individual Pop-Ups from conflicting with each other. Such advice, however, rarely extends beyond suggestions for experimentation. The only other RAM-resi-

dent utility mentioned at all in the manual is ProKey, which must be loaded first. For everything else, you must studiously determine the correct loading order yourself, or you may find yourself calling up a Pop-Up function and banishing your carefully reached keyboard macros into RAM limbo. And I bet you thought that cheaper RAM chips would solve everything, didn't you?





A composite screen showing six Pop-Up programs

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it's hard to believe.

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■ THE SHORT REPORT BY PHIL WISWELL

Analyzing and Reporting Statistics on the PC

Statistical analysis is a highly specialized field requiring years of study before you can make efficient and correct use of it on paper. First, and foremost, you need excellent math skills. A knowledge of calculus or trigonometry doesn't hurt, either. Finally, there is a lot of terminology to absorb: regression and contingency coefficients, bivariate frequency tables, quartiles, and kurtosis, to name just a few.

I've always thought of the subject as unapproachable-despite the fact that I've got plenty of data I would like to analyzebecause I've never had the time to learn enough to put it to good use. Well, what if I told you about a way to get past all the studying and right to the analysis of your data? Read on.

Stat 1: A Statistical Toolbox

Although Stat I lacks much of the window dressing common to commercial software, it is an easy-to-follow, menu-driven set of programs that performs a dozen major statistical analysis functions, such as binomial and Poisson probabilities, crosstabulation, T-test, and multiple regression. You say you don't know what those tests do? No problem. With Stat 1, you can easily try them all out by using the sample data. The menu system, on-line glossary of terms,

and context-sensitive help files let you "fake it" until you un-

derstand what you're doing. Star I's main menu lists the statistical functions along with options for setting a wide range of system defaults, entering data, and managing your data files. Data may be entered via the full-screen editor or imported as ASCII files from any other program. I was able to accomplish both without reference to the manual, which, by the way, runs 258 large pages with plenty of illustrations for those who want to dive deep. What I found most useful about the manual was a brief interactive tutorial for each kind of statistical test.

This is a program that does the iob without any fanfare: It has no color, no fancy borders. its Spartan menus consist of a title, the choices, a highlight bar for making selections, and a prompt line for major keyboard functions. Of course, help is always one key away. So if you want to do statistical analysis without learning how to analyze statistics, check out Stat I (Sugar Mill Software Corp., Kailua. HI; (808) 261-7536; \$179.95; requires 256K RAM, one floppy disk drive).

BetaSTAT

Like Stat 1. BetaSTAT is a homegrown tool, lacking any visual pizzazz. The program is



Stat 1 tools include this table of statistical functions.



ChiWriter shows complex formulas on-screen exactly as written

written in MBASIC, with source code included. Its purpose is the same as that of Stat 1: the statistical analysis of data. using a simple menu-driven system for user input. Moreover, the two programs cover a similar range of common and exotic functions. Coming out of the starting gate, they are neck and

neck. However, BetaSTAT

loses ground in the home stretch. BetaSTAT has no on-line help, and in my testing that translated to: If you already know what you're doing, you won't have any trouble with this program. Its menus present choices for analysis of variance, matrix manipulation, stepwise multiple regression, and so forth, and selecting the precise test you want is easy. Completing it.

however, is another story

Data can be entered via keyboard or through a DIF or AS-CII file, but without on-line help I got so frustrated that I didn't even want to analyze the data once I finally got it on a disk. At every point along the way in this program, I was fighting to understand what to do next

Statisticians already familiar with the terms presented on the screen will find BetaSTAT a fast, capable, versatite tool. The rest of you should steer clear (Belanger Research Associates, Azusa, CA; (818) 969-4112; \$295; recoires 192K RAM, one floppy disk drive).

ChiWriter

The analysis of statistics is only half the battle-generally, you must also polish the results into a report, complete with tables, mathematical formulas, special symbols, and so forth. I know of several \$500 programs that will do the job, but for the same money you could buy ChiWriter and a vacation.

ChiWriter is a rudimentary word processor with some very fancy formatting capabilities. You can switch between ten different fonts at any point in your document, and the program supports any number of subscript or superscript levels. I doubt there is a mathematical formula you could write on a blackboard that couldn't be imitated by ChiWriter-cither onscreen or on paper.

Statistical tables are a brecze to set up and edit with Chi-Writer, and the variety of symbols and fonts available (almost 1.000 different characters) lets you prepare a report in no time. Fonts include two sets of mathematical symbols, the Greek alphabet, script, Gothic. bold. and italic. ChiWriter's a nifty product with a price I defy you to beat and performance I defy you to snub (Horstmann Software Design, P.O. Box 4544. Ann Arbor, MI 48106; \$69.95; requires 256K RAM, one floppy disk drive. Epson or compatible printer)

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■ EDITED BY DAVID OBREGON

EWON THE MARKET



Ziyad Paper Feeders Ziyad Inc. has introduced sheet

feeders for the IBM Quietwriter and the Canon LBP-8A1 Laser printers. Both products handle 20-pound bond paper and feature two adjustable paper trays as well as an envelope tray. Paper sizes ean range from 71/4 by 101/2 inches to 81/2 by 14 inches. Error conditions, such as misfeeds and outof-paper situations, are noted by LEDs and audible signals.

The Ziyad PaperJet 300A provides the IBM Quietwriter with up to 400 sheets of paper and 75 business envelopes for printing. A software feature enables names and addresses to be captured from inside the letter and then automatically positioned and printed on the envelope. Each letter and its corresponding envelope are collated on the output stacker. The mean time between failure is rated at 6.000 hours, and the mean time to repair at 30 minutes.

The Zivad PaperJet 400 supplies the Canon LBP-8A1 Laser Printer with an additional 350 sheets of paper. It can also stack up to 75 envelopes. Output is collated and stacked face down in printed sequence. It supports RS232-C. RS422. Centronics.

and Diablo 630 computible inter faces. The factory-rated mean time to failure is 5,000 hours, and the mean time to repair is 30 min-

List Price: PaperJet 300A, \$1,295; Paperlet 400, \$1,895 Zivad Inc. 100 Ford Rd

Denville, NI 07834 (201) 627-7600

Telex: 13-6024

CIRCLE 435 ON READER SERVICE CARD The Dreamer

T.S. MicroTech Inc. has released a multifunction keyboard accessory featuring a 20-key numeric keypad with independent cursor controls as well as Esc and Enter keys. Alongside the Dreamer's numeric keypad are an additional 30 keys that have been programmed with 70 1-2-3 commands and 30 WordStar functions. The keys access such 1-2-3

commands as Data Sort Primary. Graph Options Scale Automatic,



Data Query Find, Worksheet Window Vertical, and Range Format Fixed. The WordStar keys include Copy Block, Delete Line, Find & Replace String, and

Go to Marker 0-9. The 100 commands are spread out over three built-in pages of ROM memory. Togeline betwen the pages accesses a different group of functions. LEDs indicate the currently selected page and printed keyboard; templates are also provided. T.S. MicroTech Inc. can reprogram The Dreamer for custom applications.

List Price: \$259 T.S. MicroTech Inc. 12565 Crenshaw Blvd. Hawthorne CA 90750

(213) 644-0859 CIRCLE 632 ON READER SERVICE CARD

GM 3000 Series

Okidata has announced two versions of a Vi-height floppy disk drive, intended to be marketed primarily to OEM dealers. These 51/4-inch drives come in 1.6- and 0.5-megabyte capacities, weigh less than 2 pounds each, and use from 4 to 4.5 watts.

Known as the GM 3000 se-

ries, the floppy disk drives are designed to minimize or completely eliminate adjustments in motor speed and head alignment. Each drive features a microprocessor-driven direct-drive spindle motor, a linear stepping motor in the positioner and head assembly with only one moving part and an interposer mechanism to prevent head damage should the drive door be closed without a

diskette in place.



New on the Market Submissions Guide

All submissions to New on the Market should follow these guidelines:

1. Include the retail price and details of both hardware and software needed for an end-user to properly use your new product. This includes retained amount of RAM, number and type of drives, operating systems supported, and peripheral equipment needed.

2. Releases should be type written double-spaced on one side of the paper. Copies of advertisements may be included, but in most instances we need more information than is typically included in an ad. Include telephone contacts for marketing and technical questions

3. If available, include black & white glossy photos of the product, 4 by 5 inches or larger.

New on the Market does not seview products; do not send sample or demo capies of software. All product announcements are run on a space-available basis, at the exclusive discretion of the editor. Please note that it is impossible to guarantee publication of a product amountement for any particular type

List Price: Available from the menufacture

Okidata 532 Fellowship Rd. Mt. Laurel, NJ 08504 (609) 235-2600 TWX: 710-897-0792 CROLF 642 ON READER SERVICE CARD

Advanced Symphony: A Pow-er User's Guide As part of its Software Pak line of

applications programs support packages, Wiley Professional Software has released a collection of model templates, exereises, techniques, shortcuts, and utility programs for Lotus's Symphony software. Also included in the package is a written guide,



Advanced Symphony: A Power User's Guide, which can help guide the user into mustery of Symphony's command language and windowing techniques.

Included in the Advanced Symphony: A Power User's Guide software is a program to automatically access commercial on-line databases such as CompuServe and The Source, nearly 50 word processing macros and help screens, a database generator that prompts the Symphony user through the creation of a database, and such model templates as an income and expense register.

List Price: \$47.95 Requires: 320K RAM, two disk drives, DOS 2.0 or later, Symphomy Wiley Professional Software 605 Third Ave. New York, NY 10158 (212) 850-6788 DRCLE 646 ON READER SERVICE CARD

X2C Board

ABM Computer Systems recently announced a multifunction memory and I/O board that supports the Lotus/Intel/Microsoft Extended Memory Specification Standard. The X2C Board includes such features as parallel and serial ports, a clock/calendar. up to 2 megabytes of nonvolatile RAM, automatic software configuration, and a number of software programs.

By using an optional external AC adapter power pack or an onboard Ni-Cad battery, RAMdisks can be kept alive even if the PC's power is shut down. The battery is capable of preserving the contents of one megabyte of RAM for one hour. Included with the board is an EMS-compatible memory manager driver. Because there are no jumpers or DIP switches on the board, installation requires running a configuration program on the diagnosties disk. Additional programs include a pop-up windowing print spooler, parity error correction, and RAMdisk software. The basic board comes with 256K bytes of RAM. exnandable to I megabyte. An Expansion RAM Module, the XRM, piggybacks the main board and provides another megabyte of RAM. An optional game port is also available.

List Price: With 256K RAM. \$395; additional modules: XRM without RAM, \$79; AC adapter nowemack and Ni-Cad battery, \$29 **ABM Computer Systems**

3 Whotney Dr. Irvine, CA 92714 (800) 372-8400 (714) 859-6531 Telex: 29-2427 CIRCLE 639 ON READER SERVICE CARD

RoboCAD-PC

Robo Systems Corp.'s CAD/ CAM program for the IBM PC features an icon-based interface with pull-down menus, movable palettes, and a logical command structure. The RoboCAD-PC package also features a visual library system that creates indexed sereens that maintain up to 256 miniaturized representations of separate drawings or symbols. The software includes a utility that imports and exports AutoCAD DXF files.

RoboCAD-PC provides the user with features to "rubberband" drawn elements, drag symbols, cross-hatch, and crase specified segments of elements. Other features allow filleting of lines and arcs, the ability to draw tangents from a circle to a point and from a circle to another circle, automatic dimensioning and measuring of lines, circles and arcs, and conversions between English and metric unit systems. Snap grids and angle locks are also included. In addition, a "magnetic point" feature enables the user to snap the cursor back to an endpoint, intersection, or centerpoint without loss of drawing flow

List Price: \$1,495 Regules: 256K RAM, two disk drives, DOS 2.0 or later, color graphics adapter.

Robo Systems Corp. 111 Pheasant Run Newtown, PA 18940 215) 968-4422

PICLE 633 ON PEADER SERVICE CARD FileCard.

Western Digital Enhanced Peripherals has pushed the "hard disk drive on a card" concept one step further. When mounting the 10-megabyte drive on one of its own controller eards. Western Digital left room in the design for add-ons. As it is currently being offered, the FileCard also accommodates a daughterboard with room for up to 512K bytes of RAM. Other add-ons are in the works. The eard will fit into one

slot in the IBM PC, though it re-



quires a slot and a half in the XT. The 11/4-inch thick FileCard is mounted on the company's own WD1002S-WX2 "Cobra" controller card and draws a maximum of 8 watts of power during a seek operation. The average access time is 147 milliseconds. and the transfer rate is 3.2 megabits per second. The mean time between failure is 11,000 hours. The RAM on the daughterboard can be incremented in four stages: 128, 256, 320, and 512K.

List Price: \$1,095 without RAM Western Digital Enhanced Peripherals

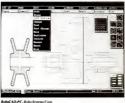
2300 Main St. Irvine, CA 92714 (714) 863,0533 TWX: 910-595-1139

CIRCLE 641 ON READER SERVICE CARD

dB Report Writer

This dBASE II and III report generator, developed by Concentric Data Systems, provides dBASE users with the means to create presentation-quality reports with a 1-2-3-like command interface

dB Report Writer analyzes the file and drafts a preliminary report format customized to the us-



er's printer configuration. With 1-2-3-like commands, the report is then rearranged in such formats as columnar, row, page-perrecord, or mailing label. Fields can be erased or moved to any position on the screen, and field names and width formats can be changed. The program features AND and OR queries, full selection rules, and parenthesization. Files can be sorted on four levels. and options include subtotal, count, sum, average, and min/ max. Approximately 50 printers and such enhancements as italic. boldface, and underlining are supported. dB Report Writer includes on-line help, an indexed user's guide, and a disk-based tutorial.

List Prices \$125 Requires: 256K RAM, one disk drive, DOS 2.0 or later. Concentric Data Systems, Inc. 18 Lyman St. P.O. Box 4063 Weuboro, MA 01581 (617) 366-1122

CIRCLE 634 ON READER SERVICE CARD Scorecard

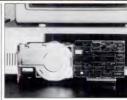
Systems Peripherals Consultans has announced a 3½-inch 20megabyte hard disk drive on a plug-in board. The card is designed to be used as a substitute for a conventional internal hard disk drive for floppy-based PC units and can be used to boot the user's system. The controller can also control a second internal or external drive.

Systems Peripherals Consultants also supply removable cartridge drives in 5- and 10megabyte capacities. The Scorecard is covered by a 1-year warranty.

List Price: \$895 Systems Peripherals Consultants 9747 Business Park Ave. San Diego, CA 92131 (619) 693-8611 CIROLE 643 ON READER SEWICE CARD

AT SpeedFixer

This memory-resident utility who have experienced disk drive errors caused by crystals running at speeds greater than 6 MHz. The manufacturer, Dynamical Systems Inc., claims that AT Speedfire, automatically corrections.



Scorecard, Systems Peripherals Consultants

rects any such disk timing errors. If you are considering souping up your AT with a faster crystal, the package also includes complete instructions for installing one, as well as instructions for increasing the hard disk drive's performance by an additional 33 percent once the new crystal is installed. Even if you have not exchanged your IBM AT's clock crystal with a faster one, you may still find the package useful. A second utility included in the package speeds up the AT keyboard's response time.

List Price: \$24.95 Dynamical Systems Inc. 2511 Fulton St. Berkeley, CA 94704 (800) 227-2400, etc. 929

CRICLE 638 ON READER SERVICE CARD Cheetah Card Cheetah International has recently developed a 2.5-megabyte No Wait State memory card for the IBM AT. The No Wait State technology enables the eard to perform an operation in two clock intervals per memory cycle rather than the three eyeles normally required by other cards. This enables the Cheetah Card to speed up non-I/O processing by 30 percent on an AT running at 6 MHz. At present, the card uses 100-nanosecond DRAMs: however, the card is so designed that when 70-nanosecond DRAMs become available, it will run an 8-MHz No Waix State: Selving a DIP switch also enables you to use the card with a Wait State on a 15-MHz AT Included software

allows you to configure up to a 10-megabyte virtual disk in memory that also runs No Wait State. Installation requires running a setup program. A 3-year limited warranty is standard.

List Price: \$945 Cheetah International Inc. 107 Community Blvd.. #5 Longview, TX 75606 0800 CHEETAH

(800) 243-3824 CRCLE 637 ON READER SERVICE CARD

Player Piano

This low-cost utility acquires data from IBM Systems 34 through 38 host computers, automatically converting it into 1-2-3 spreadsheet format. Brainwave's Player Piano does this acquisition and conversion without any file transfers, batch processing, or host processing. Data from different host databases can be combined easily. The program supports host security measures and requires an IBM 5250 Emulator or Enhanced Emulator card. Versions for other emulator eards will soon be available

List Price: \$49.95 Brainwave Computer Products P.O. Box 7022 Newport Beach, CA 92660 (712) 969-1327 CRICLE 406 ON READER SERVICE CARD

Brooks Standby Power Supply

Supply
This standby power supply from
Brook Power Systems is designed specifically to protect personal computer equipment

against a wide range of power line disturbances that can cause loss of data. During normal line conditions, the Brooks S\$ 500+ and S\$ 1000 models provide regulated, noiseless AC power, in the event that the power line voltage drops by more than 15 percent, both models automatically switch to their internal scaled bat-

teries.
The SS 500+ model internal battery can support computer equipment for 20 to 30 manuses after line failure, while the SS 1000 model can provide power for 14 to 24 minutes, depending on the line load. Both models returnaler to utility line power 2 seconds after power lane transients are attenuated before retransfer, and automatically recharge the internal battery.

List Price: Starts at \$930 Brook Power Systems 3569 Bristol Pike, #102 Bensalem, PA 19020 (800) 523-1551

(215) 244-0264 GROLF 647 ON READER SERVICE CARD

CHOLE 647 ON HEADER SER

FINDER: The Retrieval System

Unlike most database management systems, which locate records through the use of keywords, FINDER: The Retrieval System can index every word in the file and then use the inverted index for retrieval operations. This allows the system to handle extremely large databases and retrieve textual information quickly. Based on mainframe retrieval systems such as those used by LEXIS, BRS, and DIALOG, FINDER: The Retrieval System is prompt-driven rather than command-driven. It also in-



Brooks Standby Power Supply, Brook Power Systems

cludes data entry trapping, three indexing options, a variety of searching techniques and output formats, and functions to operate on sets of records.

A record in FINDER: The Retrieval System can be up to 9,999 screens in length. Indexing options include none, an entire field as one term, and multiple terms within a field delimited by a character such as a space. In addition to textual searches with left- and right-hand truncation, FINDER: The Retrieval System also searches ranges of values and proximity occurrences. Characters within words can be masked. A search creates a set consisting of those records that satisfied the criteria. That set can then be compared or combined with other sets of records with the use of logical operators. FINDER: The Retrieval System also provides functions for determining a numeric field's total value, high value, low value, average, and the number of records with a value greater than

The software also includes FINDERlink, an import utility that allows file transfers from word processors, database systems, mainframes, and optical character scanners. When dealing with unstructured data such as that found in text files, you insert flags to instruct the program which information goes into which field.

List Price: \$1,800 Regulres: 128K RAM, bard disk drive, DOS 2.0 or later. Finder Information Tools Inc. 1422 W. Peachtree St. NW, #518

Atlanta GA 30300 (404) 872-FTFT CRCLE 440 ON DEADED SERVICE CARD

TekTouch Interactive Panel Tektronix has announced a touch-sensitive panel that can be overlaid on existing CRT, electroluminescent, and plasma display screens, permitting a user to input data by direct touch. The

TekTouch panel is based on the use of a transparent, resistive continuous film deposited directly onto a glass panel. This method eliminates many of the disadvantages of other touch-screen technologies, including displayimage distortion and deterioration of a panel after long use.

Intended initially to be offered to systems developers and designers, the TekTouch can be ordered in quantity in sizes up to 25 inches diagonally; prototypes are currently available in sizes up to 13 inches diagonally. Driver



MIDI Ensemble, Sight & Sound Music Software Inc

electronics for the TekTouch can be mounted on conventional or specially designed boards.

List Price: Single prototype, \$800 Tektronix Inc. P.O. Box 500 Beaverton, OR 97077 (503) 644-0161 CIRCLE 648 ON READER SERVICE CARD.

MIDI Ensemble

Sight & Sound Music Software Inc. is offering a program allowing owners of MIDI (Musical Instrument Digital Interface) equipment to quickly record, share and refine music with an IBM PC. MIDI Ensemble comprises three main program modules-Recorder, Event Editor, and Phrase Editor-as well as a builtin text and graphics editor for linking text or diagrams to song files. A comprehensive setup utility permits the user to tailor the system to specific equipment. The Recorder module lets

you record and overdub tracks like a multitrack tape recorder (with over 255 separate tracks), with such additional features as a programmable metronome, track transpositions, clapsed time measurement (real-time or frames), and interfaces to external controllers (tape sync, MIDI clock, MIDI song position pointer). The Event Editor allows the user to edit music tracks in microscopic detail, providing a special graphics display that simplifies the precise editing of pitch, start time, duration, and key-strike velocity of any note on a track.

MIDI Ensemble's Phrase Editor permits the user to specify beginning and end points of music segments, which can then be copied, moved, deleted, combined, and modified. Segments (phrases) can be of any length and are graphically displayed on a color monitor.

List Price: \$495 Requires: 256K RAM, two disk

drives, DOS 2.0 or later, color/ graphics adapter, Roland DG MPU-401 MIDI processor, Roland DG MIF-IBM interface card. Sight & Sound Music ftware Inc.

3200 S. 166th St New Berlin, WI 53151 (414) 784-5850

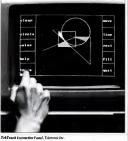
CIRCLE 644 ON READER SERVICE CARD

Emerald 201C Modem A downsized 2,400-bit-per-sec-

ond modern that fits neatly under a standard telephone is being offered by the Emerald Technology Group Inc. The Emerald 201C Modem features digital signal processing under microprocessor control, which aids in reducing data errors caused by poor line quality. The modem also includes several diagnostic test functions and a front-panel LED display indicating communications status such as Transmit and Receive and Carrier Detect.

Emerald Technology Group Inc. 12011 NE First St., #305 Bellevue, WA 98005 (206) 462-8400 CIRCLE 645 ON READER SERVICE CARD

List Price: \$685



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have to do anything again; it does it all for you — like lightning.

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What's it like to use it? If you have ever worked with or seen a RAM Disk you know what a difference speed can make when working with any program that accesses the disk. Well,

IJCHTIMING enables any program to approach the same rapid speed as a RAM Disk, but it does it without the isadvantages. With a RAM Disk there is a constant danger that you can lose your precious data if you forget to copy it back to the disk drive. With IJCHTIMING you just use your programs normally. You don't have to remember anything.

LCHTINICG has a fun feature that shows you just how fast you're operating. Any time you want, with a couple of keystrokes you can see a screen that keeps a record of how many times you've accessed the disk, and how much time LCHTINICG has saved you. It's fun to check it out, and it's always astounding.

When you work with a database program or most word processors, or any time you need to frequently load files into RAM or save them back, you are accessing your disk. It is such a pleasure to cut those times in half and often to one-fourth.

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CIRCLE 615 ON READER SERVICE CARE PC MAGAZINE . MARCH II. 1986

PC MART

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GETTING STARTED IN COMMUNICATIONS



These four books, with varying success, help beginners master the complexities of on-line networks, information services, bulletin boards, and mail systems.

Not long ago, computer communications was an area where only started, beginners have to know both to get their systems up and running and what to do with them once they get there. They must learn about moderns, communications programs, telecommunications networks, on-line systems, and more. None of these subject is particularly complicated, but the sheer amount of information can be intimidating.

As little as 3 years ago, newcomers were on their own. Today, several books offer to help the beginner over the initial hump. While all these books have a great deal in common, they also differ markedly in scope.

A QUICK GUIDED TOUR Online: A foulde to America's Leading Information Services, by Steve Lambert, is the most superficial of the four books reviewed here. Don't expect much help from Online in getting your system running. Lambert assumes that most readers already have their systems set up, and he devotes only one chapter to moderns, communications software, and installation of moderns. This quick look at features is probably

sufficient for beginners if they have a working system that someone else set up for them. It is not enough to guide beginners through choosing and setting up a system by themselves.

Most of the book is devoted to on-line systems, but Lambert covers just seven of the most popular—MCI Mail, Compu-Serve, NewsNet, DIALOG, Dow Jones News/Retrieval, OAG, and Western Union EasyLink/FYI. His stated purpose is to give a guided tour of each. For better or worse, he lives up to that goal.

Online includes two or three sample online sessions for each system covered. The idea is that you sign on to the various systems and step through the menus or commands following Lambert's examples.

The problem with this approach is that it will teach you little that you can't quickly learn on your own. Basically Lambert winds up rehashing the systems' own manuals instead of adding useful tricks of his own.

This book also includes a gimmick in the form of alleged savings on system registration and on-line time. The book jacket calls this a \$350 value, but this is part hype: most moderns and communications programs come packaged with a similar set of free offers. And some of the \$350 "value" is standard issue in any case.

 "Get Connected" is chock full of information.

Unfortunately, getting

to that useful information is harder than it should be. Online may serve as a starting point for the beginner or the exceptionally timid, but even they will find little reason to keep this book around for later reference.

INTRODUCING COMMUNICATIONS Compute!'s Telecomputing on the IBM, by Arlan R. Levitan and Sheldon Leemon, is an adequate introduction to computer communications, but no more than that.

Roughly the first third of this book is devoted to basics and to the issue of how to choose a modern and communications program for the IBM PC and PCJr. This first section has some gaps and oversimplifications. The only mention of cabling for external moderns, for example, is that such cables "must usually be purchased separately." On the plus side, the chapter on software includes critiques of seven popular MS-DOS communications programs.

The bulk of this book deals with ten popular on-line systems: CompuServe CIS, CompuServe EIS, The Source, Dow Jones New/Retrieval, Roweldge Index, BRS/After Dark, Delphi, PLATO Homelink, NewsNer, and MCI Mail. Much to their credit, Levitan and Leemon go beyond an introductory tour, giving a knowledgeable critique of each system and an overview of the services available.

I suspect that beginners will find this approach much more useful than Lambert's—particularly if they are trying to decide which systems to sign up with. Beginners will also appreciate the last two chapters, which cover bulletin boards and file transfers. These subjects are of only peripheral interest when you are using a

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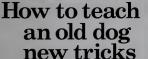
commercial system but are important for a practical understanding of computer communications. While this book lacks depth, it may be enough for those whose interest is best described as casual.

TELECOMMUNICATIONS REFER-ENCE Get Connected: A Guide to Tele-

communications, by Tom Kieffer and Terry Hansen, is probably the most ambitious of these four books.

With its 423 8- by 10-inch pages standing well over an inch thick, Get Connected reminds me of nothing so much as a college textbook, complete with two-column ayout. As you might expect from any such massive book, this one is chock full of information. Unfortunately, getting to that useful information is far harder than it should be.

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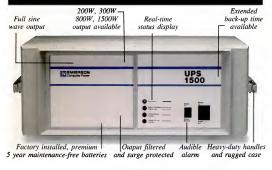
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The Complete Hondbook of Personal Computer Communications: Everything You Need to Go Online with the World Alfred Glossbrenner St. Martin's Press 175 Fifth Ave.

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BOOK REVIEW

puzzling. Kieffer and Hansen devote well over half the book to what amounts to a catalog of hundreds of on-line services. A catalog can serve an important purpose as a reference book, but I can't see any point in

reading through one from beginning to end. And that's exactly what Kieffer and Hansen expect their readers to do.

This design is doubly curious in that the book is well-organized as a reference

book, with banking services grouped together, shopping services grouped together, and so forth. What's missing is a crossindexed subject guide—or even informative chapter titles. (The chapter on electronic mail is called "It's a Small World")

This book would have been much more useful if Kieffer and Hansen had approached it as a reference book. As it stands, Get Connected can serve as a helpful reference guide, but only if you're willing to take the time to learn what's in it.

ALL YOU NEED TO KNOW The Computer Handbook of Personal Computer Communications: Everything You Need to Go Online with the World, by Alfradio Glossbrenner, originally published in 1983, was the first good introduction to communications for the beginner. This newly revised edition—not only updated, but nearly two-thirds again as large—

covers more material in greater depth.

In the first version of this book, Glossbrenner covered The Source, CompuServe, Dow Jones News/Retrieval, Dialog, BRS, Orbit, and NewsNet—along
with a few more general chapters on electronic shopping, bulletin board systems,
and the like.

and the list.

In this revision, he adds coverage of Delphi, Knowledge Index, BRS/Arel, Electronic investing, electronic mail, and even a chapter on teles systems, and even a chapter on teles systems, and even a chapter on teles systems, or the state of the system of

The informative section headings in the table of contents and the thorough index in the back of the book will also be greatly appreciated.

Glossbrenner's admirable feat has been to write a highly readable book that is useful for the beginner but still contains enough information to be valuable as a reference. If you're interested in computer communications, this book belongs on your shelf.

M. David Stone is a regular contributor to PC Magazine and author of Getting Online, from Prentice-Hall, 1984.





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COMING UP

ENHANCED GRAPHICS MONI-TORS Like any popular PC peripheral, the IBM Enhanced Color Display has spawned a litter of competitors. PC Magazine Labs tests the IBM original against three other monitors that support the fabulous IBM Enhanced Graphics Adapterthe Amdek Color 722, the Princeton Graphic Systems HX-12E, and the NEC JC-1401P3A Multisynch.

COLOR GRAPHICS MONITORS The trusty IBM Color Display remains the standard color monitor, despite heavy competition. But for users who have special needs or who just like to fiddle with lots of controls, the monitor marketplace is full of attractive options. PC Magazine Labs screen-tests 13 monitors that run the IBM color/graphics adapter.

HARD DISK CARDS Although hard disk cards have been available for only a few months, consumers are flocking to buy them. Hard disk cards are more expensive than most conventional hard drives. but their competitive edge is their easy installation. Charles Bermant reviews competing hard disk cards and looks at the industry's response to this new technology.

AT&T'S TRUEVISION HIGH-PER-FORMANCE GRAPHICS BOARD AND TIPS SOFTWARE A new group of high-performance graphics boards and software from AT&T's EPICenter are attracting well-deserved attention. The VDA/D board, ICB board, and TARGA series of boards generate higher-quality images by increasing the number of onscreen colors, letting you blend colors more subtly, and capturing video images. The TIPS series of graphics design software takes full advantage of these features.

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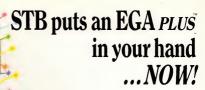


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